NASA

Aerospace Medicine and Biology
A Continuing Bibliography with Indexes

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National Aeronautics and Space Administration

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NASA SP-7011(335)

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(Supplement 335)

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in March 1990 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*

National Aeronautics and Space Administration
Office of Management
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INTRODUCTION

This Supplement to *Aerospace Medicine and Biology* lists 143 reports, articles and other documents announced during March 1990 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA).* The first issue of the bibliography was published in July 1964.

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. In general, emphasis is placed on applied research, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the bibliography consists of a bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* or *STAR,* including the original accession numbers from the respective announcement journals. The *IAA* items will precede the *STAR* items within each category.

Seven indexes — subject, personal author, corporate source, foreign technology, contract, report number, and accession number — are included.

An annual index will be prepared at the end of the calendar year covering all documents listed in the 1990 Supplements.

Information on the availability of cited publications including addresses of organizations and NTIS price schedules is located at the back of this bibliography.

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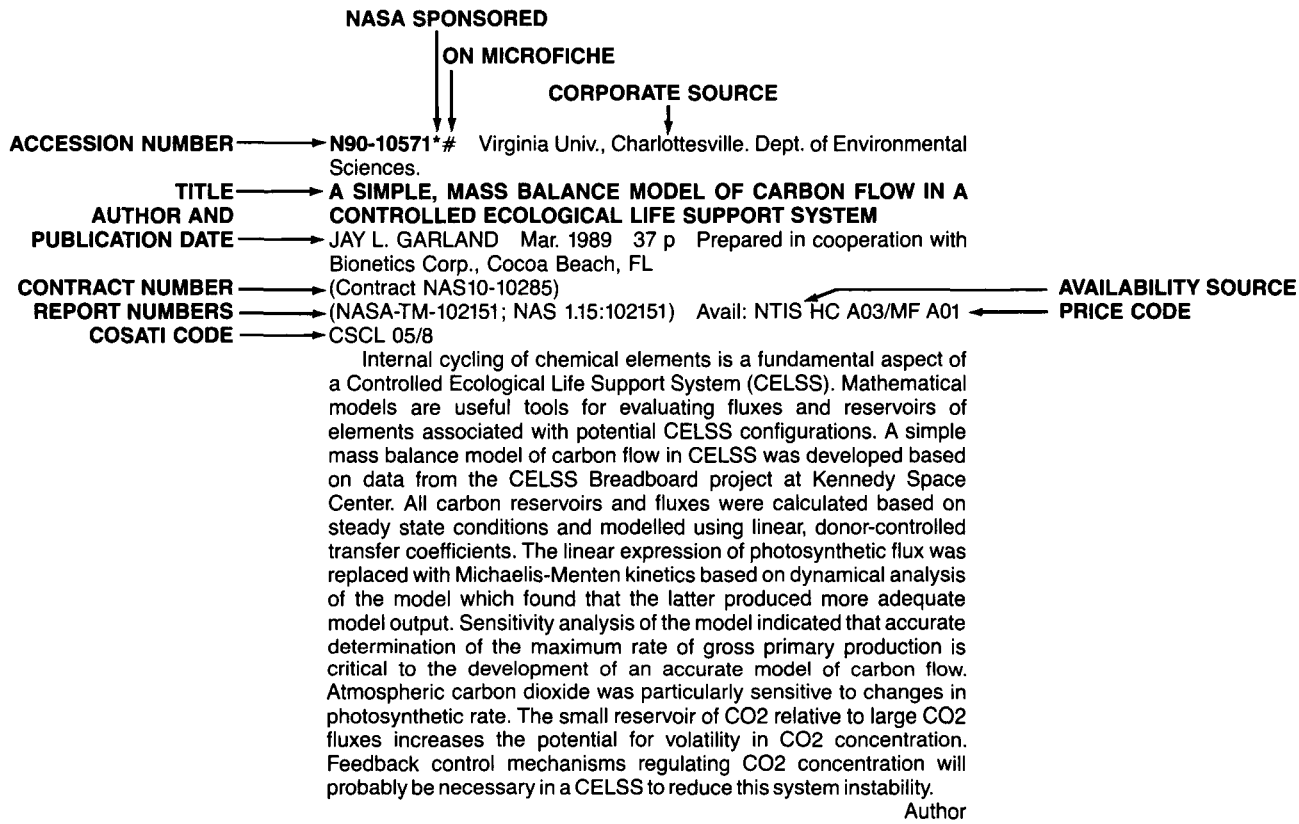
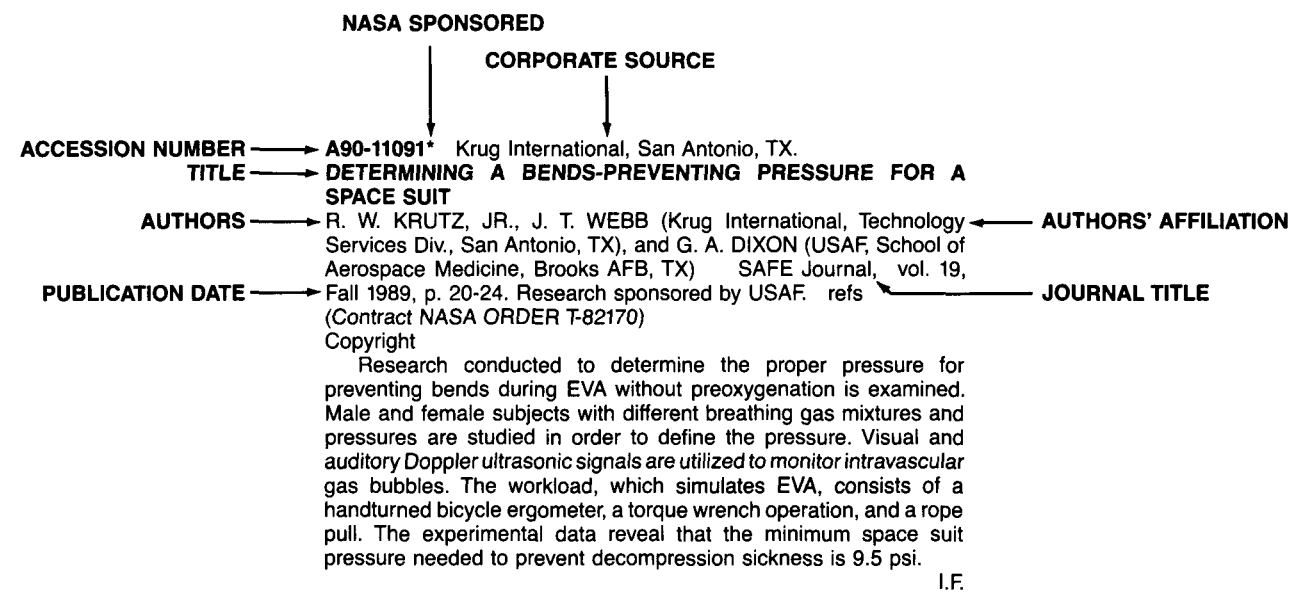
TYPICAL REPORT CITATION AND ABSTRACT



TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT



AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 335)

APRIL 1990

51

LIFE SCIENCES (GENERAL)

A90-16657* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
AN OVERVIEW OF SELECTED BIOMEDICAL ASPECTS OF MARS MISSIONS
JOHN BILLINGHAM (NASA, Ames Research Center, Moffett Field, CA) IN: The case for Mars III: Strategies for exploration - General interest and overview. San Diego, CA, Univelt, Inc., 1989, p. 157-169. refs
(AAS PAPER 87-189) Copyright

There are major unresolved questions about changes in physiology of the crews of future zero-gravity manned Mars mission vehicles. This paper summarizes the changes induced by long duration weightlessness in different body systems, and emphasizes the need for further research into these changes using animal and human subjects in space and in ground-based simulations. If the changes are shown not to be acceptable, it will be necessary to provide artificial gravity for the crew. Artificial gravity itself produces some physiological problems, and these also require extensive study. Both lines of research must be pursued with some urgency so that the major decision to have or not to have artificial gravity can be made on the basis of adequate information. Author

A90-16694
HYPOTHESES ON THE MECHANISMS OF THE HIGH-PRESSURE NEUROLOGICAL SYNDROME [HYPOTHESES SUR LES MECANISMES DU SYNDROME NERVEUX DES HAUTES PRESSIONS]
LAURENT FAGNI (Centre de Pharmacologie et d'Endocrinologie, Montpellier, France), FATIHA ZINEBI, MAURICE HUGON, and JEAN-CLAUDE ROSTAIN (CNRS, Laboratoire de Biologie des Hautes Pressions, Marseille, France) Revue Scientifique et Technique de la Defense (ISSN 0994-1541), 2nd Quarter, 1989, p. 115-128. In French. Research supported by DRET and IFREMER. refs
Copyright

Pharmacological studies performed on in vivo and on in vitro models to elucidate the cellular mechanisms involved in the high-pressure neurological syndrome are reviewed. It is shown that several neurotransmitter systems may participate in the development of this syndrome. B.J.

A90-17116
THE EFFECT OF ADAPTATION TO HEAT AND ENHANCED MOTOR ACTIVITY ON THE THERMOREGULATIVE FUNCTION OF THE MOTONEURONAL POOL [VLIIANIE ADAPTATSII K TEPLU I POVYSHENNOI DVIGATEL'NOI AKTIVNOSTI NA TERMOREGULIATSIONNUIU FUNKTSIIU MOTONEIRONNOGO PULA]
L. P. KUOKKANEN (Petrozavodskii Gosudarstvennyi Universitet, Petrozavodsk, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 75, Aug. 1989, p. 1063-1068. In Russian. refs
Copyright

The effect of adaptation to a high temperature environment combined with intensive motor activity on the thermoregulative function of the motoneuronal pool was investigated in rats maintained either at 19-22 C (in the winter-spring season) or 21-24 C (in the summer-fall season) and trained to run on an exercise wheel 5-6 times a week for 5-7 weeks at a speed of 15 m/min. The changes elicited by the adaptation were registered as changes in bioelectric activity of several leg and hip muscles. The adaptation to heat combined with motor activity was found to induce an increase in the motoneuron frequency discharges. I.S.

A90-17117
THE ROLE OF CATECHOLAMINERGIC SYNAPSES IN THE FORMATION MECHANISM OF ADAPTATIONS MEDIATED BY POLYPHENOLIC ADAPTOGENS [O ROLI KATEKHOLAMINERGICHESKIKH SINAPSOV V MEKHANIZME FORMIROVANIIA ADAPTATSII PRI UCHASTII POLIFENOL'NYKH ADAPTOGENOV]
A. V. LUPANDIN (Khabarovskii Gosudarstvennyi Institut Fizicheskoi Kul'tury, Khabarovsk, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 75, Aug. 1989, p. 1082-1088. In Russian. refs
Copyright

The interactions of polyphenolic adaptogens (substances extracted from the Schizandra or the Manjurian aralia) and quercine with agonists and antagonists of catecholaminergic synapses and with the inhibitors of enzymes involved in the synthesis and transformations of catacholamines were investigated in rats and mice treated with quercetin or extracts of Schizandra and Manjurian aralia. Results indicate that the major target of polyphenolic adaptogens is catechol-O-methyltrasferase. It was found that the inhibition of this enzyme caused the adaptogens to exert a correcting effect on the catecholaminergic (mainly dopaminergic) synapses and to inhibit the reduction of the transmitter. I.S.

A90-17118
INTERRELATIONSHIPS AMONG THE ARTERIAL PRESSURE, CARDIAC OUTPUT, AND CORONARY FLOW DURING ORTHOSTATIC REACTIONS [VZAIMOOTNOSHENIIA MEZHDU ARTERIAL'NYM DAVLENIEM, SERDECHNYM VYBROSOM I KORONARNYM KROVOTOKOM PRI ORTOSTATICHESKIKH REAKTSIIAKH]
L. I. OSADCHII, T. V. BALUEVA, and I. V. SERGEEV (AN SSSR, Institut Fiziologii, Leningrad, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 75, Aug. 1989, p. 1126-1132. In Russian. refs
Copyright

The effects of hypotension on the cardiac output and coronary flow were investigated in cats with an orthostasis-induced hypotension. It was found that the body tilt to 15-60 deg resulted in lowering the mean arterial pressure, which, beginning from the 30-deg tilt, paralleled the reduction of cardiac output. The systolic-pressure and the cardiac-output decreases were significantly lower under the 60-deg tilt than at the 30-deg tilt, although there was no significant difference in the diastolic pressure. The results suggest a participation of the vascular constrictor responses in the formation of orthostatic reactions. I.S.

A90-17249
PROTEIN SYNTHESIS IN THE ORGANS OF LONG-TAILED SIBERIAN SUSLIK (CITELLUS UNDULATUS) AT DIFFERENT FUNCTIONAL STATES [SINTEZ BELKA V ORGANAKH DLINNOKHVOSTYKH SUSLIKOV /CITELLUS UNDULATUS/ PRI RAZLICHNYKH FUNKTSIONAL'NYKH SOSTOIANIIAKH]
V. I. ZAGNOIKO, A. K. GULEVSKII, and L. G. MISHNEVA (AN USSR, Institut Problem Kriobiologii i Kriomeditsiny, Kharkov, Ukrainian SSR) Akademiia Nauk SSSR, Izvestiia, Seriia Biologicheskaia (ISSN 0002-3329), Nov.-Dec. 1989, p. 862-869. In Russian. refs
Copyright

The rate of protein synthesis in the brain and liver of Citellus undulatus was measured in cell-free extracts obtained from fully active (June) and hibernating (December-January) animals, using radioactive amino acids and an inhibitor of protein synthesis (cyclohexamide). It was found that, during hibernation, the ribosomal pool was maintained at the level similar to that of active animals. It is suggested that the fall in the level of protein content and in amino-acid incorporation observed in hibernating animals is caused by temperature-dependent inhibition of various enzymes and factors involved in the translational phase of protein synthesis. I.S.

A90-17273
CHANGES IN THE NEUTRAL PEPTIDE-HYDROLASES OF BLOOD AND CATECHOLAMINES OF TISSUES DURING ADAPTATION TO ALPINE HYPOXIA [IZMENENIE NEITRAL'NYKH PEPTIDGIDROLAZ KROVI I KATEKHOLAMINOV TKANEI PRI ADAPTATSII ORGANIZMA K VYSOKOGORNOI GIPOKSII]
A. A. IVASHKEVICH and N. N. NAGNIBEDA (AN USSR, Institut Fiziologii, Kiev, Ukrainian SSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 35, Sept.-Oct. 1989, p. 59-64. In Russian. refs
Copyright

The effects of hypoxia on the dynamics of the blood-plasma activity of neutral peptide-hydrolases and the content of catecholamines in the brain and adrenal glands of rats were investigated by comparing animals maintained at sea level with those kept for 18 days at the altitudes of 2100 m or 3500 m. It was found that, after three days of altitude hypoxia, the activity of neutral peptide-hydrolases and the content of adrenaline in the adrenal cortex increased, while the content of noradrenaline decreased. After 10 days of hypoxia, the enzyme activity and the glandular content of adrenaline returned to normal. On the 18th day, there was a second increase of the enzyme activity, while the catecholamine contents remained below the control levels. Results suggest a role of the neutral peptide-hydrolases in the adaptation to alpine hypoxia. I.S.

A90-17275
THE ROLE OF PEROXIDATION IN THE MECHANISM OF STRESS [ROL' PEREKISNOGO OKISLENIIA V MEKHANIZME STRESSA]
V. A. BARABOI (Kievskii Rentgenoradiologicheskii i Onkologicheskii Institut, Kiev, Ukrainian SSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 35, Sept.-Oct. 1989, p. 85-97. In Russian. refs
Copyright

This paper proposes a stress-response mechanism, in which the products of lipid peroxidation (LPO) are the primary as well as the secondary mediators, the first being the consequence of the direct effect of a stress factor on tissues, and the second a consequence of long-term catecholemia. In this mechanism, the mobilization of stress-realizing systems is regarded as an adequate response of the autooxidative system to the primary activation of LPO. The role of intermediates of the quinoid metabolism as the LPO initiators is discussed together with the role of antioxidants as agents for the prophylaxis and early treatment of stress-related injuries. I.S.

A90-17483* Indiana Univ., Bloomington.
AN ISOTOPIC STUDY OF BIOGEOCHEMICAL RELATIONSHIPS BETWEEN CARBONATES AND ORGANIC CARBON IN THE GREENHORN FORMATION
J. M. HAYES, BRIAN N. POPP, RAY TAKIGIKU, and MARCUS W. JOHNSON (Indiana University, Bloomington) Geochimica et Cosmochimica Acta (ISSN 0016-7037), vol. 53, Nov. 1989, p. 2961-2972. Research supported by the John Simon Guggenheim Memorial Foundation and Bureau of Mineral Resources of Australia. refs
(Contract NGR-15-003-118; NSF PCM-84-04996)
Copyright

Carbon-isotopic compositions of total carbonate, inoceramid carbonate, micritic carbonate, secondary cements, total organic carbon, and geoporphyrins have been measured in 76 different beds within a 17-m interval of a core through the Greenhorn Formation, an interbedded limestone and calcareous shale unit of Cretaceous age from the Western Interior Seaway of North America. Results are considered in terms of variations in the processes of primary production and in secondary processes. It is shown that the porphyrin isotopic record reflects primary isotopic variations more closely than the TOC isotopic record and that, in these sediments, TOC is enriched in C-13 relative to its primary precursor by 0.6 to 2.8 percent. This enrichment is attributed to isotope effects within the consumer foodweb and is associated with respiratory heterotrophy. Variation in this secondary enrichment are correlated with variations in the isotopic composition of marine carbonate. C.D.

A90-17518* Texas Univ., Houston.
PULMONARY HEMODYNAMICS, EXTRAVASCULAR LUNG WATER AND RESIDUAL GAS BUBBLES FOLLOWING LOW DOSE VENOUS GAS EMBOLISM IN DOGS
B. D. BUTLER, J. CONKIN, and S. LUEHR (Texas, University, Houston) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, Dec. 1989, p. 1178-1182. refs
(Contract NAG9-215)
Copyright

A90-17525* Little (Arthur D.), Inc., Cambridge, MA.
THE INITIAL BLOOD STORAGE EXPERIMENT - THE SPACEFLIGHT HARDWARE PROGRAM
DAVID W. ALMGREN, KATINKA I. CSIGI, PETER E. GLASER, ROBERT M. LUCAS, and RICHARD H. SPENCER (Arthur D. Little, Inc., Cambridge, MA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, Dec. 1989, p. 1215-1221.
(Contract NAS9-17222)
Copyright

The Initial Blood Storage Experiment (IBSE) was conceived to investigate the effects of microgravity on the formed elements of human blood. The experiment flew on the January 1986, 61-C mission of the Space Shuttle Columbia. The experiment hardware was designed to provide a closely controlled temperature and air flow environment for all blood samples. During the mission, two IBSE modules were on board the orbiter and an identical set of hardware and blood samples were maintained on earth as a control. This paper describes the development and performance of the IBSE hardware which was converted from a conceptual design to an on-orbit, man-rated, mid-deck locker experiment in 17 months. Author

A90-17713* National Aeronautics and Space Administration, Washington, DC.
CURRENT STATUS AND FUTURE DIRECTION OF NASA'S SPACE LIFE SCIENCES PROGRAM
RONALD J. WHITE and BARBARA F. LUJAN (NASA, Life Sciences Div., Washington, DC) IN: Working in orbit and beyond: The challenges for space medicine. San Diego, CA, Univelt, Inc., 1989, p. 1-7.
(AAS PAPER 87-152) Copyright

The elements of the NASA Life Sciences Program that are related to manned space flight and biological scientific studies in space are reviewed. Projects included in the current program are

outlined and the future direction of the program is discussed. Consideration is given to issues such as long-duration spaceflight, medical support in space, readaptation to the gravity field of earth, considerations for the Space Station, radiation hazards, environmental standards for space habitation, and human operator interaction with computers, robots, and telepresence systems. R.B.

A90-17772
NEW CONSTRAINTS ON EARLY TERTIARY PALAEOPRODUCTIVITY FROM CARBON ISOTOPES IN FORAMINIFERA
LOWELL D. STOTT (Southern California, University, Los Angeles, CA) and JAMES P. KENNETT (California, University, Santa Barbara) Nature (ISSN 0028-0836), vol. 342, Nov. 30, 1989, p. 526-529. Research supported by NSF and USSAC. refs
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A90-17774
ISOLATION OF A GENE REGULATED BY HYDROSTATIC PRESSURE IN A DEEP-SEA BACTERIUM
DOUGLAS BARTLETT (Agouron Institute; California, University, La Jolla), MIRIAM WRIGHT, MICHAEL SILVERMAN (Agouron Institute, La Jolla, CA), and A. ARISTIDES YAYANOS (California, University, La Jolla) Nature (ISSN 0028-0836), vol. 342, Nov. 30, 1989, p. 572-574. Research supported by the U.S. Navy. refs
Copyright

A90-17941
HINDLIMB SUSPENSION SUPPRESSES MUSCLE GROWTH AND SATELLITE CELL PROLIFERATION
KEVIN C. DARR and EDWARD SCHULTZ (Wisconsin, University, Madison) Journal of Applied Physiology (ISSN 0161-7567), vol. 67, Nov. 1989, p. 1827-1834. refs
(Contract NIH-AR-38033)
Copyright

Results are given from a study of the effects of long-term hindlimb unweighting by tail suspension on postnatal growth of 20-day rat extensor digitorum longus and soleus muscles. Consideration is given to changes in body mass and muscle growth and nuclear changes. Both the number and proliferative activity of satellite cells in both types of muscles were greatly reduced in individual myofibers after only three days of hindlimb suspension. In the soleus, this reduction in number and proliferation of satellite cells continued for 30 days, resulting in 43 percent fewer myonuclei and 45 percent fewer satellite cells than control soleus. In the extensor digitorum longus, however, the activity of satellite cells rapidly returned to weight-bearing control after 10 days of suspension. R.B.

A90-17944
CHANGES IN BODY TEMPERATURE OF RATS ACCLIMATED TO HEAT WITH DIFFERENT ACCLIMATION SCHEDULES
OSAMU SHIDO, YORIKO YONEDA, and TETSUO NAGASAKA (Kanazawa University, Japan) Journal of Applied Physiology (ISSN 0161-7567), vol. 67, Nov. 1989, p. 2154-2157. refs
Copyright

A90-18924
A NOVEL GROUP OF ABYSSAL METHANOGENIC ARCHAEBACTERIA (METHANOPYRUS) GROWING AT 110 C
R. HUBER, M. KURR, K. O. STETTER (Regensburg, Universitaet, Federal Republic of Germany), and H. W. JANNASCH (Woods Hole Oceanographic Institution, MA) Nature (ISSN 0028-0836), vol. 342, Dec. 14, 1989, p. 833, 834. Research supported by DFG and NSF. refs
Copyright

A novel group of methanogenic archaebacteria growing at least at 110 C has been isolated from sediment samples taken by the research submersible Alvin at the Guaymas Basin hot vents in the Gulf of California. This finding demonstrates the unexpected biogenic methanogenesis at temperatures above 100 C, and in view of biogeochemistry, could explain isotope discrimination at temperatures that were thought to be unfavorable for biological methanogenesis. C.D.

A90-18925
MASSIVE NATURAL OCCURRENCE OF UNUSUALLY LARGE BACTERIA (BEGGIATOA SP.) AT A HYDROTHERMAL DEEP-SEA VENT SITE
HOLGER W. JANNASCH, CARL O. WIRSEN (Woods Hole Oceanographic Institution, MA), and DOUGLAS C. NELSON (California, University, Davis) Nature (ISSN 0028-0836), vol. 342, Dec. 14, 1989, p. 834-836. Research supported by NSF. refs
Copyright

A90-19253
WATER CONTENT AND DISTRIBUTION IN TISSUES OF SEVERAL VISCERAL ORGANS IN CONDITIONS OF LOWERED MUSCLE ACTIVITY [SODERZHANIE I RASPREDELENIE VODY V TKANIAKH NEKOTORYKH VISTSERAL'NYKH ORGANOV V USLOVIIAKH SNIZHENIIA MYSHECHNOI AKTIVNOSTI]
M. V. ABDUSAMATOVA and Z. T. TURSUNOV (AN USSR, Institut Fiziologii, Tashkent, Uzbek SSR) Akademiia Nauk Uzbekskoi SSR, Doklady (ISSN 0134-4307), no. 9, 1989, p. 56-58. In Russian. refs
Copyright

The role of visceral organs in the phenomena of water accumulation and loss during hypokinesia was investigated in mice subjected to hypokinesia for 10, 20, 30, 40, 50, or 60 days. It was found that the total content in the tissues of the myocardium and the kidneys did not change, although, in both tissues, there was a decrease in the extracellular water content accompanied by an increase in intracellular water. In the stomach, total water content increased during all periods of hypokinesia; on the 10th and 20th day the increase was due to increases in extracellular fluid, while after the 30th day, it was due to the intracellular water accumulation. In the small intestine, tissue water decreased. In the first 30 days this decrease was due to water loss in the intracellular compartment; on the 40th and 50th days, it was due to water loss in both compartments; and on the 60th day, it was due only to water loss in the extracellular compartment. I.S.

A90-19301* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADIATION EFFECTS IN CAENORHABDITIS ELEGANS - MUTAGENESIS BY HIGH AND LOW LET IONIZING RADIATION
GREGORY A. NELSON, WAYNE W. SCHUBERT, TAMARA M. MARSHALL (JPL, Pasadena, CA), ERIC R. BENTON, and EUGENE V. BENTON (San Francisco, University, CA) Mutation Research (ISSN 0027-5107), vol. 212, 1989, p. 181-192. refs
(Contract NAS7-918)
Copyright

The nematode C. elegans was used to measure the effectiveness of high-energy ionized particles in the induction of three types of genetic lesions. Recessive lethal mutations in a 40-map unit autosomal region, sterility, and X-chromosome nondisjunction or damage were investigated. Induction rates were measured as a function of linear energy transfer, LET(infinity), for nine ions of atomic nunmber 1-57 accelerated at the BEVALAC accelerator. Linear kinetics were observed for all three types of lesions within the dose/fluence ranges tested and were found to vary strongly as a function of particle LET(infinity). Relative biological effectiveness (RBE) values of up to 4.2 were measured, and action cross sections were calculated and compared to mutagenic responses in other systems. Author

N90-13915# Connecticut Univ., Farmington. Surgical Research Center.
GENERATION OF FREE RADICALS DURING COLD INJURY AND REWARMING
JAISIMHA LYENGAR, SASWATI SAMANTA, ANNA GEORGE, JOHN C. RUSSELL, and DIPAK K. DAS 1988 22 p

(Contract N00014-88-K-0546)
(AD-A213088) Avail: NTIS HC A03/MF A01 CSCL 06/10

Cold injury is often associated with irreversible cell damage. The present study examines the mechanism of such injury. New Zealand white rabbits were anesthetized with ketamine and xylazine, and then ventilated. The femoral artery and vein were exposed. A continuous display of electrocardiogram was obtained. One leg was cooled with a freezing mixture up to 0 C, which was followed by rewarming; the other leg served as control. Blood samples were withdrawn from the femoral artery for analysis of creatine kinase (CK), lactate dehydrogenase (LDH), and malonaldehyde (MDA). At the end, salicylate was injected through the femoral vein to trap any hydroxyl radical (OH) formed. Rabbits were immediately sacrificed, and biopsies were withdrawn and frozen at liquid Nitrogen temperature to analyze OH. Local blood flow in the cold-exposed leg was reduced significantly, suggesting that cold injury was associated with ischemic insult. CK and LDH were increased after cold exposure, then increased further during rewarming. MDA formation followed a similar pattern. OH generated after cooling increased significantly upon rewarming. These results indicate that rewarming is associated with an episode of ischemia/perfusion, with simultaneous generation of free radicals which, at least in part, may be responsible for cellular injury associated with rewarming. GRA

N90-13916*# Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
MEASUREMENT OF THE LIGHT FLUX DENSITY PATTERNS FROM LUMINAIRES PROPOSED AS PHOTON SOURCES FOR PHOTOSYNTHESIS DURING SPACE TRAVEL
PAUL N. WALKER 1 Dec. 1989 57 p
(Contract NAG10-0059)
(NASA-CR-186124; NAS 1.26:186124) Avail: NTIS HC A04/MF A01 CSCL 06/2

Two luminaires were evaluated to determine the light flux density pattern on a horizontal plane surface. NASA supplied both luminaires; one was made by NASA and the other is commercially available. Tests were made for three combinations of luminaire height and luminaire lens material using the NASA luminaire; only one configuration of the commercial luminaire was tested. Measurements were made using four sensors with different wavelength range capabilities. The data are presented in graphical and tabular formats. Author

N90-13917# European Space Agency, Paris (France).
LIFE SCIENCE RESEARCH IN SPACE
H. OSER, ed. and B. BATTRICK, ed. Jul. 1989 137 p Original contains color illustrations
(ESA-SP-1105; ISBN-92-9092-012-2; ISSN-0379-6566; ETN-90-95761) Copyright Avail: NTIS HC A07/MF A01; ESA Publications Division, ESTEC, Noordwijk, Netherlands, 40 Dutch guilders

The life science research carried out to date in low gravity conditions is summarized. The areas of research covered are: human physiology, developmental biology, plant biology, cell biology, radiation biology, exobiology, life support systems for man, and bioprocessing. The direction of future research and possible applications of such research are described. The European Space Agency life science facilities are described. These include the sled facility, the Biorack and the Anthorack facilities. ESA

N90-14761*# Florida Univ., Gainesville. Dept. of Aerospace Engineering.
ENGINEERING SCIENCES DESIGN. DESIGN AND IMPLEMENTATION OF COMPONENTS FOR A BIOREGENERATIVE SYSTEM FOR GROWING HIGHER ORDER PLANTS IN SPACE Final Report
GALE E. NEVILL, JR. Apr. 1989 106 p
(Contract NASW-4435)
(NASA-CR-186056; NAS 1.26:186056; EGM-4001) Avail: NTIS HC A06/MF A01 CSCL 06/3

The primary goal was to address specific needs in the design of an integrated system to grow higher plants in space. With the needs defined, the emphasis was placed on the design and fabrication of devices to meet these needs. Specific attention was placed on a hand-held harvester, a nutrient concentration sensor, an air-water separator, and a closed-loop biological system simulation. Author

N90-14762# Florida Univ., Gainesville. Dept. of Physiology.
HIGH-FREQUENCY VENTILATION IN DOGS WITH THREE GASES OF DIFFERENT DENSITIES Final Technical Report
MARC L. JAEGER Aug. 1989 75 p
(Contract N00014-85-K-0123)
(AD-A212862) Avail: NTIS HC A04/MF A01 CSCL 23/5

Dogs were ventilated with a high frequency oscillation, HFO, device varying the frequency (2 to 20 Hz), the tidal volume (25 to 100 ml), and the resident gas (He, N2, SF6). Tidal volume was measured with a body plethysmograph. Blood gases were measured after a quasi steady state was established. The kinematic viscosity of the breathing gas mixture, which changed by 1700 pct, was found to have little effect on arterial P(sub O2) and P(sub CO2). The results are consistent with findings in a model which consisted of tubes of different diameters and with the theory of Taylor-type diffusion. In addition, experiments were performed reducing and increasing the equipment dead space. This resulted in changes of P(sub O2) and that were appreciably less than those resulting from variations of tidal volume of the same magnitude. These results suggest that, high frequency ventilation (HFV), at increased and decreased ambient pressure is technically possible. GRA

N90-14763*# Lockheed Engineering and Sciences Co., Washington, DC.
USSR SPACE LIFE SCIENCES DIGEST. INDEX TO ISSUES 21-25
LYDIA RAZRAN HOOKE, ed. NASA 31 Jan. 1990 100 p
(Contract NASW-4292)
(NASA-CR-3922(30); NAS 1.26:3922(30)) Avail: NTIS HC A08 CSCL 06/3

This bibliography provides an index to issues 21 through 25 of the USSR Space Life Sciences Digest. There are two sections. The first section lists bibliographic citations of abstracts in these issues, grouped by topic area categories. The second section provides a key word index for the same abstracts. The topic categories include exobiology, space medicine and psychology, human performance and man-machine systems, various life/body systems, human behavior and adaptation, biospherics, and others. Author

N90-14764# Argonne National Lab., IL. Chemistry Div.
FACTORS AFFECTING ELECTRON SPIN POLARIZATION IN PHOTOSYNTHETIC SYSTEMS
M. C. THURNAUER, L. L. FEEZEL, A. L. MORRIS, U. SMITH, and J. R. NORRIS 1989 4 p Presented at the 8th International Congress on Photosynthesis, Stockholm, Sweden, 6-11 Aug. 1989 Submitted for publication
(Contract W-31-109-ENG-38)
(DE90-000196; CONF-8908117-6) Avail: NTIS HC A01/MF A01

A model was developed for the electron spin polarized (esp) in P(sub 870)(sup +)Q(sup -) which includes contributions of both P(sub 870)(sup +)I(sup -) and P(sub 870)(sup +)Q(sup -) interactions to the esp of P(sub 870)(sup +)Q(sup -). It was shown how factors such as kinetics, magnetic interactions, and structure affect the esp. This model can then be applied to assess the esp in PSI in terms of primary electron transfer steps. DOE

N90-14765# Northwestern Univ., Evanston, IL. Dept. of Biochemistry, Molecular Biology, and Cell Biology.
COMPARISON OF STRUCTURAL SUBUNITS OF THE CORE LIGHT-HARVESTING COMPLEXES OF PHOTOSYNTHETIC BACTERIA
PAUL A. LOACH, PAMELA S. PARKES-LOACH, MARY C. CHANG, BARBARA A. HELLER, PEGGY L. BUSTAMANTE, and TOMASZ MICHALSKI (Argonne National Lab., IL.) 1989 10 p Presented at the Molecular Biology of Photosynthetic Prokaryotea Symposium,

Freiburg, Fed. Republic of Germany, 2-5 Aug. 1989 Submitted for publication
(Contract W-31-109-ENG-38; GM-11741; NSF DMB-87-17997)
(DE90-001412; CONF-8908164-1) Avail: NTIS HC A03/MF A01

Development of the biochemical methodology for preparation of structural subunits of the core LH complex and their reconstitution from individual components has provided a tool for probing structure-function relationships at three different levels: BCh1 binding, polypeptide interaction within the LH complex, and interaction between the LH complex and the RC. Further cultivation of this experimental approach should provide improved knowledge about how BCh1 is bound and how the LH complex performs its function. DOE

N90-14766# California Univ., Berkeley. Lawrence Berkeley Lab.
X RAY MICROIMAGING FOR THE LIFE SCIENCES
DAVID ATTWOOD, ed. and BOB BARTON, ed. Aug. 1989 206 p Presented at the Conference on X ray Microimaging for the Life Sciences, Berkeley, CA, 24-26 May 1989
(Contract DE-AC03-76SF-00098)
(DE90-002613; LBL-27660; CONF-8905192) Avail: NTIS HC A10/MF A02

The workshop brought together the physical and biological science communities to explore the potential for imaging of macromolecular to sub-organelle structures, in their natural state, with spacial resolutions beyond those hitherto demonstrated. Emphasis was on direct imaging techniques applied to biological problems of structure and function, sequencing, and mapping. The requisite high brightness radiation sources, such as short wavelength undulators and x ray lasers, were also addressed. In addition there were overviews of current and projected capabilities utilizing tunneling techniques, electron microscopy, and x ray crystallographic techniques. Individual papers are processed separately for the data base. DOE

52

AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

A90-16658* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
ARTIFICIAL GRAVITY FOR LONG DURATION SPACEFLIGHT
MALCOLM M. COHEN (NASA, Ames Research Center, Moffett Field, CA) IN: The case for Mars III: Strategies for exploration - General interest and overview. San Diego, CA, Univelt, Inc., 1989, p. 171-178.
(AAS PAPER 87-190) Copyright

This paper reviews the fundamental physical properties of gravitational and centrifugal forces, describes the physiological changes that result from long-term exposure to the nearly gravity-free environment of space, and explores the nature of these changes. The paper then cites currently employed and advanced techniques that can be used to prevent some of these changes. Following this review, the paper examines the potential use of artificial gravity as the ultimate technique to maintain terrestrial levels of physiological functioning in space, and indicates some of the critical studies that must be conducted and some of the trade-offs that must be made before artificial gravity can intelligently be used for long duration spaceflight. Author

A90-17119
CORRECTING THE THERMAL STATE OF THE HUMAN BODY AT THE THREAT OF OVERHEATING [KORREKTSIIA TEPLOVOGO SOSTOIANIIA ORGANIZMA CHELOVEKA PRI UGROZE PEREGREVANIIA]
N. A. SLEPCHUK, V. I. BASAKIN, and K. P. IVANOV (AN SSSR, Institut Fiziologii, Leningrad; Vladimirskii Gosudarstvennyi Pedagogicheskii Institut, Vladimir, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 75, Aug. 1989, p. 1162-1169. In Russian. refs
Copyright

The effects of cooling the surfaces of hands, legs, and feet on the body temperature of human subjects subjected to overheating were investigated by measuring changes of temperature in various body regions of healthy males resting in the sitting position in a constant-temperature room kept at 38-39 C. It was found that cooling the hands or the leg-and-foot areas led to improvements of the thermal state. Cooling both of these areas simultaneously was even more effective, resulting in sensations of 'comfort' and 'coolness'; the values of the temperature in the external auditory canal, the average skin temperature, and the average body temperature were found to decrease significantly. I.S.

A90-17120
BIORHYTHMIC MECHANISMS OF ADAPTIVE SELF-REGULATION OF FUNCTIONS - THE INTERCONNECTION AND CYCLICITY OF THE INTERCOMPONENT AND INTERSYSTEM INTERACTIONS [BIORITMOLOGICHESKIE MEKHANIZMY ADAPTIVNOI SAMOREGULIATSII FUNKTSII - SVIAZNOST' I TSIKLICHNOST' MEZHKOMPONENTNYKH I MEZHSISTEMNYKH VZAIMODEISTVII]
N. N. VASILEVSKII (AMN SSSR, Nauchno-Issledovatel'skii Institut Eksperimental'noi Meditsiny, Leningrad, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 75, Sept. 1989, p. 1177-1183. In Russian. refs
Copyright

This paper presents the results of investigations in the field of adaptive self-regulation of physiological functions. It is shown that the mechanisms of adaptive functional self-regulation are based on biorhythms. These findings point to new approaches that can be used to assess the human capability of adapting to new conditions and of correcting functional irregularities by means of nonpharmacological control of neural, vegetative, and somatic functions. I.S.

A90-17214
THE PROBLEM OF VISUAL ILLUSIONS IN FLIGHT PERSONNEL [K PROBLEME ZRITEL'NYKH ILLIUZII U LETNOGO SOSTAVA]
IU. V. KAMENSHCHIKOV and I. G. OVECHKIN Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), Sept. 1989, p. 42-44. In Russian.
Copyright

This paper presents the results of a survey conducted in more than 600 pilots of fighter and fighter-bomber aircraft, in which the subjects were asked to answer questions concerning various aspects of the occurrence of visual illusions during flights. Results indicate that 92 percent of pilots did experience illusions at one time or another. The paper describes the types of illusions encountered by the subjects, and presents data on their frequency, causes, the conditions of observations, the sensations occurring during the illusions, as well as the effect of various types of illusions on the quality of piloting. I.S.

A90-17274
A PROCEDURE FOR STUDYING CHANGES OF THE COMMON CENTER OF GRAVITY IN HUMANS (STABILOMETRY) [METODIKA ISSLEDOVANIIA KOLEBANII OBSHCHEGO TSENTRA TIAZHESTI CHELOVEKA /STABILOMETRIIA/]
V. N. KAZAKOV, V. IA. UMANSKII, IU. E. LIAKH, and A. I. KLIMENKO (Donetskii Gosudarstvennyi Meditsinskii Institut, Donetsk, Ukrainian SSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 35, Sept.-Oct. 1989, p. 82-84. In Russian. refs
Copyright

This paper describes a novel procedure, termed stabilometry, for monitoring changes of the common center of gravity in humans, together with the instrumentation used in this method. The device

used to sense the center-of-gravity fluctuations is based on the biological feedback principle and involves measurements of the nervous system activity. I.S.

A90-17402
TEN YEARS OF ACCELERATION RESEARCH
BIJAN ESHAGHIAN, ESTRELLA M. FORSTER (Krug International Corp., Technology Services Div., San Antonio, TX), and JOSEPH R. FISCHER, JR. (USAF, School of Aerospace Medicine, Brooks AFB, TX) IN: Annual SAFE Symposium, 26th, Las Vegas, NV, Dec. 5-8, 1988, Proceedings. Newhall, CA, SAFE Association, 1989, p. 1-4. Research sponsored by USAF. refs
Copyright

Since 1978, physiologic responses of 1,300 subjects on 21,752 G exposures (the majority of these runs are +G/z/ exposures) have been recorded in a centrifuge data repository established at the USAF School of Aerospace Medicine. The centrifuge data repository has a wide range of benefits: (1) physiologic response standards (normal values) can be established on the basis of large numbers of exposures; (2) human acceleration safety can be analyzed by frequent tabulation of these data; and (3) equipment use can be continuously monitored for its reliability. Author

A90-17403
MEASURING HEART RATE RESPONSE TO THE WINGATE CYCLE ERGOMETER TEST
J. F. WIEGMAN (Krug International Corp., Technology Services Div., San Antonio, TX), G. A. DREW, and S. F. STRANGES (USAF, School of Aerospace Medicine, Brooks AFB, TX) IN: Annual SAFE Symposium, 26th, Las Vegas, NV, Dec. 5-8, 1988, Proceedings. Newhall, CA, SAFE Association, 1989, p. 5-9. Research sponsored by USAF.
Copyright

This paper describes data collection procedures developed for upper and lower body Wingate Anaerobic Tests (WAT) and details the use of an Automatic R-Wave Tracker (ART) for on-line determination of real-time heart rate (HR) during dynamic exercise. This project originated as part of a larger study which investigates the relationship between results of the WAT, a test to quantify anaerobic abilities, and acceleration tolerance measured on the USAFSAM human-use centrifuge. As part of that investigation, it was necessary to develop a system for monitoring and recording HR during the 30-second, maximal-effort exercise bouts. The multistage, R-wave filter eliminates baseline shifts, reduces motion artifact, and suppresses T waves. The amplitude detector allows for millisecond timing of R-R intervals while automatically adjusting for R-wave amplitude changes. Successful use of ART during this exercise task suggests its usefulness for on-line data collection during high-intensity activities such as rapid-onset acceleration. Author

A90-17404
AUDIO AND VISUAL ULTRASONIC MONITORING OF ALTITUDE DECOMPRESSION SICKNESS
C. L. BAAS, R. M. OLSON (Krug International Corp., Technology Services Div., San Antonio, TX), and G. A. DIXON (USAF, School of Aerospace Medicine, Brooks AFB, TX) IN: Annual SAFE Symposium, 26th, Las Vegas, NV, Dec. 5-8, 1988, Proceedings. Newhall, CA, SAFE Association, 1989, p. 22-26. Research sponsored by USAF. refs
Copyright

A two-dimensional ultrasound imaging system is presented for the monitoring of high altitude decompression sickness circulatory system bubbles in affected aircrews. The device encompasses both visual and Doppler auditory real-time information on bubble formation. The placement of the ultrasound transducer over the precordium, in the acoustic window located between the fourth and sixth intercostal space, yields a modified four-chamber view of the heart; bubbles, when present, can be both seen within the heart and heard in the flow signal. O.C.

A90-17409
EFFECT OF DIFFERENT SCHEDULES OF ASSISTED POSITIVE PRESSURE BREATHING ON G-LEVEL TOLERANCE
J. M. CLERE, D. LEJEUNE, D. TRAN-CONG-CHI, H. MAROTTE, and J. L. POIRIER (Centre d'Essais en Vol, Laboratoire de Medecine Aerospatiale, Bretigny-sur-Orge, France) IN: Annual SAFE Symposium, 26th, Las Vegas, NV, Dec. 5-8, 1988, Proceedings. Newhall, CA, SAFE Association, 1989, p. 76-79. refs
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Experimental runs have been conducted on an anti-G aircrew suit with and without the operation of Assisted Positive Pressure Breathing (APPB), under two conditions: (1) full-pressure at +2 G(z), and (2) full pressure when the experimental subject reported the loss of 100 percent of the peripheral visual field. An evaluation is made of the effect of different schedules of APPB on G-tolerance. APPB is shown to improve G-level tolerance by 1.45 to 2.53 G. O.C.

A90-17410
PILOT REACTION TO HIGH G STRESS ON THE HUMAN CENTRIFUGE
J. R. FISCHER, JR., L. J. MEEKER, K. K. GILLINGHAM (USAF, School of Aerospace Medicine, Brooks AFB, TX), and J. T. WEBB (Krug International Corp., Technology Services Div., San Antonio, TX) IN: Annual SAFE Symposium, 26th, Las Vegas, NV, Dec. 5-8, 1988, Proceedings. Newhall, CA, SAFE Association, 1989, p. 80-82.
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In the modern high performance aircraft a pilot is often faced with high-G stress which, if not countered, can lead to loss of consciousness and, consequently, to loss of control of the aircraft. To increase pilot safety and to protect government investment, the United States Air Force (USAF) began a program in January 1985, to train pilots in procedures to counter the effects of high-G stress. Using the human centrifuge in the Crew Technology Division of the USAF School of Aerospace Medicine (USAFSAM), each pilot ws exposed to five G profiles: a gradual onset run (GOR) to 9 G, and 4 rapid onset runs (ROR) ranging to 9 G. Data from approximately 2,100 pilots provide an opportunity to study on a large scale and in a controlled environment, pilot reactions to high G. This paper investigates the training-related G-induced loss of consciousness (G-LOC) rates, estimates the GOR-G tolerance for the pilot population, and evaluates the effectiveness of the training program. Author

A90-17414
THE EFFECT OF VARIOUS AMOUNTS OF LOWER BODY NEGATIVE PRESSURE ON THE PHYSIOLOGIC EFFECTS INDUCED BY HEAD-DOWN TILT
LLOYD D. TRIPP, JOHN FRAZIER (USAF, Harry G. Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH), BRADLEY G. BECK (Wright State University, Dayton, OH), THOMAS JENNINGS (Illinois, University, Chicago), and CHARLES GOODYEAR (Systems Research Laboratories, Inc., Dayton, OH) IN: Annual SAFE Symposium, 26th, Las Vegas, NV, Dec. 5-8, 1988, Proceedings. Newhall, CA, SAFE Association, 1989, p. 122-127. refs
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Human tolerance to -G(z) acceleration is about -2.5 G(z). The USAF Armstrong Aerospace Medical Laboratory has investigated lower body negative pressure (LBNP) as a means of increasing -G(z) tolerance. An analysis of the experimental results obtained for five subjects indicates that LBNP had a dramatic effect on cardiovascular parameters, decreasing end-diastolic volume and end-systolic volume significantly while increasing heart rate and decreasing stroke volume; LBNP is accordingly recommended as a countermeasure for head-down tilt. O.C.

A90-17423
VISUAL DOMINANCE TRAINING - A METHOD OF SPATIAL ORIENTATION TRAINING? (A CALL FOR RESEARCH)
KENNETH S. S. MONTGOMERY and ROBERT A. G.

MONTGOMERY, JR. (AeroMedical Training Institute, Southampton, PA) IN: Annual SAFE Symposium, 26th, Las Vegas, NV, Dec. 5-8, 1988, Proceedings. Newhall, CA, SAFE Association, 1989, p. 186-191. refs
Copyright

This paper proposes a method for spatial orientation training for combating spatial disorientation in flight (SDF), called visual dominance training, which uses a well-structured instrumental cross-check and involves a procedure of 'making the instruments read appropriately'. The rationale for the visual dominance training, its instructional application, and the research necessities are discussed. I.S.

A90-17516
HYPERVENTILATION RESPONSE TO COLD WATER IMMERSION - REDUCTION BY STAGED ENTRY
JOHN S. HAYWARD and COLIN D. FRENCH (Victoria, University, Canada) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, Dec. 1989, p. 1163-1165. refs
Copyright

Staged immersion of humans into cold water was investigated to determine whether the hyperventilation response could be reduced by this behavioral technique. A simple, two-stage procedure involving immersion to the waist for 30 s before full immersion to neck level was compared to nonstaged immersion. For the staged immersion, maximum values of respiratory minute volume and respiratory frequency were significantly reduced by 35 percent and 38 percent, respectively, from the maxima observed for nonstaged immersion. These results indicate that if staged immersion into cold water is possible, it can attenuate the hyperventilation response and, therefore, the probability of sudden drowning. Author

A90-17517
HEAT LOSS CAUSED BY IMMERSING THE HANDS IN WATER
S. D. LIVINGSTONE, R. W. NOLAN, and S. W. CATTROLL (Defence Research Establishment Ottawa, Protective Sciences Div., Canada) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, Dec. 1989, p. 1166-1171. refs
Copyright

The effect of immersing the hands up to the wrist in cold water to alleviate heat strain was examined in volunteers wearing chemical protective clothing and gloves. Each subject, who was monitored with skin and rectal thermistors, was observed while walking on a treadmill at two different work rates (283 + or - 47 and 455 + or - 58 watts) at 23 C and at a resting state at 35 C. After 20 min of work at 23 C or after 120 min in the hot room, the hands were immersed in water at temperatures of 10, 15, 20, 25, and 30 C. The amount of heat lost via the hands ranged between 124 + or - 14 and 31 + or - 4 watts and was greater, the colder the water and harder the work. In most cases, this amount of cooling was sufficient to decrease skin temperature and lower the rate of increase of core temperature. It is concluded that this method may be used to decrease resting time when working in the heat. Author

A90-17519
THE EFFECT OF HYPOXIA UPON MACULAR RECOVERY TIME IN NORMAL HUMANS
OLAF BRINCHMANN-HANSEN and KJELL MYHRE (Ulleval University Hospital; Royal Norwegian Air Force, Institute of Aviation Medicine, Oslo, Norway) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, Dec. 1989, p. 1183-1186. refs
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Bright light illumination (photostress) of the macula produces a negative after-image in the form of a central scotoma. The time needed for restoring normal visual acuity function, 'macular recovery time', may be measured using a nyctometer. The recovery was measured in 30 normal men, aged 18 to 23 years, at sea level and at 8,000 ft, 15,000 ft, and 18,000 ft of simulated altitudes in a low-pressure chamber. The degree of initial recovery (the first 30-40 s) was unaffected by hypoxia equivalent to 8,000, 15,000, and 18,000 ft. The recovery at 2 min was impaired by hypoxia at an altitude of 18,000 ft ($p = 0.009$) but not at 8,000 ft or 15,000 ft. The initial phase of recovery may represent the neural phase of macular function and appears to be more resistant to hypoxia than the recovery at 2 min, the latter probably being dominated by photochemical recovery. The study establishes a critical level of hypoxia where complete recovery of macular sensitivity is not achieved. Author

A90-17520
PERIPHERAL VASCULAR REFLEXES ELICITED DURING LOWER BODY NEGATIVE PRESSURE
ANITA TRIPATHI, GARY MACK, and ETHAN R. NADEL (John B. Pierce Foundation; Yale University, New Haven, CT) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, Dec. 1989, p. 1187-1193. refs
(Contract NIH-HL-20634; NIH-HL-17732)
Copyright

To study the interaction between thermal reflexes and baroreflexes on human forearm vasomotor and venomotor control, and to test the hypothesis that peripheral veins are responsive to baroreceptor unloading during gravitational stress, lower body negative pressure (LBNP) between 10 and 50 mm Hg (Torr) was imposed at ambient temperatures (Ta) of 28 and 37 C. Arterial and central venous pressures (CVP), heart rate, forearm venous volume, forearm venous pressure, and forearm blood flow were measured in 12 volunteers. Decreases in CVP were relatively large at 10 mm Hg LBNP at both Ta, and less thereafter. Arterial systolic and pulse pressures were not significantly reduced until LBNP exceeded 30 mm Hg. With LBNP up to 20 mm Hg, moderate decreases in forearm venous compliance and increases in forearm vascular resistance occurred. Between 30 and 50 mm Hg LBNP, the changes in both compliance and resistance per unit change in CVP were more than tripled. It is concluded that unloading of cardiopulmonary mechanoreceptors stimulates increases in both forearm vasomotor and venomotor tone and that addition of arterial baroreceptor unloading adds to these reflex responses. Author

A90-17521
EFFECTS OF GRAVITOINERTIAL FORCE VARIATIONS ON VERTICAL GAZE DIRECTION DURING OCULOMOTOR REFLEXES AND VISUAL FIXATION
GILLES CLEMENT, CLAUDIE ANDRE-DESHAYS, and CORINNA E. LATHAN (CNRS, Laboratoire de Physiologie Neurosensorielle, Paris, France) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, Dec. 1989, p. 1194-1198. Research supported by the Universities Space Research Association. refs
(Contract CNES-520061)
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Recordings of horizontal and vertical eye movement were obtained on eight subjects exposed to repeated patterns of vertical and horizontal optokinetic stimulation, visual fixation with a fixed or unseen target, and voluntary head oscillation in the high force and free-fall periods of parabolic flight. The downward shift of the beating field of vertical optokinetic nystagmus observed in previous experiments was confirmed in the present study. The same directional shift was also noticed during optokinetic after-nystagmus. Vertical direction of gaze clearly shifted downward during the decreased gravitoinertial force level when subjects were exposed to horizontal optokinetic stimulation, or when they attempted to track an unseen target in the dark with the head stationary or actively moved up and down. Author

A90-17522
A FLIGHT SURGEON'S PERSONAL VIEW OF AN EMERGING ILLNESS
WILLIAM T. HARVEY Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, Dec. 1989, p. 1199-1201. refs
Copyright

This paper describes the personal experience of a retired Air Force flight surgeon and instrument-rated civilian pilot with an illness, presently known as the 'chronic fatigue syndrome' (CFS)

which, at the time of the first occurrence of his symptoms (March-April, 1988) was largely unrecognized or discounted by the medical community. The symptoms occurring during certain phases of the illness included: (1) cognitive dysfunction and orthostatic intolerance; (2) emotional lability, depression, and anxiety; and (3) severe fatigue. A long 'rule-out' list of similarly presenting illnesses, including Lyme disease, brucellosis, lupus, and AIDS, was exhausted. Evidence is accumulating that CFS is widely prevalent and its incidence is increasing. I.S.

A90-17523
CONTROL OF SIMULATOR SICKNESS IN AN AH-64 AVIATOR
JEFFERY D. KROLL (USAF, Office of the Flight Surgeon, Fort Hood, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, Dec. 1989, p. 1202, 1203. refs

An active 33-year-old Army AH-64 aviator with simulator sickness refractory to routine preventive measures was successfully managed with transdermal scopolamine. Although adaptation is the ultimate means for control of simulator sickness, the use of anti-motion sickness medication, specifically transdermal scopolamine, may be a useful adjuvant in selected aviators. Author

A90-17524
NEUROBEHAVIORAL AND MAGNETIC RESONANCE IMAGING FINDINGS IN TWO CASES OF DECOMPRESSION SICKNESS
HARVEY S. LEVIN, FELICIA C. GOLDSTEIN, KARYL NORCROSS, EUGENIO G. AMPARO, FAUSTINO GUINTO, C., JR. (Texas, University, Galveston) et al. Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, Dec. 1989, p. 1204-1210. refs

Two divers underwent neurobehavioral examinations and magnetic resonance imaging (MRI) while hospitalized during the first 2 weeks after sustaining decompression sickness (DCS). Their neurologic findings included a Brown-Sequard Syndrome consistent with spinal cord lesion, and focal deficits consistent with cerebral lesion(s). MRI revealed subcortical white matter lesions in the brains of both divers, whereas no lesion of the spinal cord was demonstrated. The patients exhibited neurobehavioral sequelae including disturbances of memory, divergent thinking, and visuospatial and motor functioning. Focal neurologic deficits resolved in both patients, and their cognitive and memory problems improved slowly. Findings in these two divers raise the possibility that cerebral insult more frequently accompanies spinal cord injury in DCS than previously thought. Author

A90-17712
WORKING IN ORBIT AND BEYOND: THE CHALLENGES FOR SPACE MEDICINE
VICTORIA GARSHNEK, ED. (George Washington University, Washington, DC), CLAUDE CADOUX, ED. (Union Memorial Hospital, Baltimore, MD), and DAVID B. LORR, ED. San Diego, CA, Univelt, Inc. (Science and Technology Series. Volume 72), 1989, 185 p. For individual items see A90-17713 to A90-17722.

Papers on space medicine are presented, covering topics such as the direction of the NASA life science program, vestibular factors influencing biomedical support for humans in space, biomedical research on reduced gravity, medical aspects of the Space Phoenix Program, and bone and muscle maintenance during long-term spaceflight. Other topics include cardiovascular responses to microgravity, space medicine and the Soviet space program, the efficacy of medical countermeasures in space, health maintenance on the Space Station, and radiation hazards in LEO, polar orbit, GEO, and deep space. Additional subjects include solar system exploration, spaceflight and the cardiopulmonary system, simulation facilities of the Soviet space program, and postflight recovery measures and long-duration spaceflight. R.B.

A90-17715
BONE AND MUSCLE MAINTENANCE IN LONG-TERM SPACE FLIGHT, WITH COMMENTARY ON THE AGING PROCESS
STANLEY R. MOHLER (Wright State University, Dayton, OH) IN: Working in orbit and beyond: The challenges for space medicine. San Diego, CA, Univelt, Inc., 1989, p. 29-36. refs
(AAS PAPER 87-156)

Experiments on bone homeostasis and muscle degeneration during the Skylab 2, 3, and 4 missions are reviewed. The results from these studies are outlined and suggestions are made for possible future research topics, including countermeasures to microgravitational changes in bone and muscle and the optimal types and levels of exercise needed for maintaining health during long-term spaceflight. R.B.

A90-17716* National Aeronautics and Space Administration, Washington, DC.
CARDIOVASCULAR RESPONSES TO MICROGRAVITY - ADAPTATION, MALADJUSTMENT, AND COUNTERMEASURES
F. ANDREW GAFFNEY (NASA, Life Sciences Div., Washington, DC) IN: Working in orbit and beyond: The challenges for space medicine. San Diego, CA, Univelt, Inc., 1989, p. 37-43. refs
(AAS PAPER 87-157)

Humans have worked in space for up to 237 days without significant inflight limitations, although major cardiovascular disability is seen following space flight of even a few days duration. Most of the cardiovascular research on microgravity deconditioning has been observational in character. Detailed studies of mechanisms and causes of postflight exercise intolerance, low blood pressure and fainting in astronauts and cosmonauts have not been done, despite almost 30 years of manned space flight. A review of possible mechanisms of postflight cardiovascular deconditioning and directions for study is provided. Author

A90-17717
SOVIET MANNED SPACE FLIGHT - PROGRESS THROUGH SPACE MEDICINE
VICTORIA GARSHNEK (George Washington University, Washington, DC) IN: Working in orbit and beyond: The challenges for space medicine. San Diego, CA, Univelt, Inc., 1989, p. 45-57. refs
(AAS PAPER 87-158)

An historical overview of the Soviet space program is given, focusing on the role of space medicine in manned spaceflight. Consideration is given to biomedical studies conducted on the Salyut and Mir space stations. Current topics of Soviet research in space medicine are listed. The countermeasures used by the Soviet space program during long-term spaceflight are examined, including exercise programs, the Penguin suit for maintaining the musculoskeletal system, the Chibis vacuum suit, salt water loading, nutritional countermeasures and the use of drugs. Also, consideration is given to postflight recovery activities. R.B.

A90-17719* National Aeronautics and Space Administration, Washington, DC.
ASSESSMENT OF THE EFFICACY OF MEDICAL COUNTERMEASURES IN SPACE FLIGHT
A. E. NICOGOSSIAN, F. SULZMAN (NASA, Life Sciences Div., Washington, DC), M. RADTKE (Management and Technical Services Co., Washington, DC), and M. BUNGO (NASA, Johnson Space Center, Houston, TX) IN: Working in orbit and beyond: The challenges for space medicine (A90-17712 05-52). San Diego, CA, Univelt, Inc., 1989, p. 79-86.
(AAS PAPER 87-160)

Changes in body fluids, electrolytes, and muscle mass are manifestations of adaptation to space flight and readaptation to the 1-g environment. The purposes of this paper are to review the current knowledge of biomedical responses to short- and long-duration space missions and to assess the efficacy of countermeasures to 1-g conditioning. Exercise protocols, fluid hydration, dietary and potential pharmacologic measures are evaluated, and directions for future research activities are recommended. Author

A90-17721* National Aeronautics and Space Administration, Washington, DC.
THE EFFECTS OF SPACE FLIGHT ON THE CARDIOPULMONARY SYSTEM
ARNAULD E. NICOGOSSIAN, F. ANDREW GAFFNEY (NASA, Life Sciences Div., Washington, DC), and VICTORIA GARSHNEK (George Washington University, Washington, DC) IN: Working in orbit and beyond: The challenges for space medicine. San Diego, CA, Univelt, Inc., 1989, p. 111-120. refs
(AAS PAPER 87-164) Copyright

Alterations of the human cardiopulmonary system in space flight are examined, including fluid shifts, orthostatic intolerance, changes in cardiac dynamics and electromechanics, and changes in pulmonary function and exercise capacity. Consideration is given to lower body negative pressure data from Skylab experiments and studies on the Space Shuttle. Also, echocardiography, cardiac dysrhythmias during spaceflight, and the role of neural mechanisms in circulatory control after spaceflight are discussed. R.B.

A90-17813
SPACE MEDICINE COMES DOWN TO EARTH
V. GARSHNEK (George Washington University, Washington, DC) Space Policy (ISSN 0265-9646), vol. 5, Nov. 1989, p. 330-332.
Copyright

The influence of research in space medicine on health care on earth is discussed. Advances in biotelemetry are examined, noting the use of biotelemetry on earth for treatment of patients in remote locations that lack full hospital services. Consideration is given to modifications of the conventional CPR technique that have resulted from space research, the development of research instruments with practical medical applications, and space research on the aging process. R.B.

A90-17877
GUIDANCE ON RADIATION RECEIVED IN SPACE ACTIVITIES
Bethesda, MD, National Council on Radiation Protection and Measurements (NCRP Report, No. 98), 1989, 237 p. refs
Copyright

The potential effects of radiation on the crews of planned space missions are analyzed on the basis of compiled U.S. and Soviet measurement data, and specific recommendations are presented. Topics addressed include the history of space radiation guidelines and the reasons for the present reappraisal, the space radiation environment (radiation belts, Galactic cosmic rays, and solar-particle events), radiation exposure to personnel, radiobiological features of the space radiation environment, and radiation protection standards. Diagrams, drawings, graphs, and extensive tables of numerical data are provided. T.K.

A90-17940* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
WORK CAPACITY DURING 30 DAYS OF BED REST WITH ISOTONIC AND ISOKINETIC EXERCISE TRAINING
J. E. GREENLEAF, E. M. BERNAUER, A. C. ERTL, T. S. TROWBRIDGE, and C. E. WADE (NASA, Ames Research Center, Moffett Field; California, University, Davis; U.S. Army, Letterman Army Institute of Research, San Francisco) Journal of Applied Physiology (ISSN 0161-7567), vol. 67, Nov. 1989, p. 1820-1826. refs
(Contract NAG2-140; DA PROJECT 3A161101A-91C)
Copyright

Results are presented from a study to determine whether or not short-term variable intensity isotonic and intermittent high-intensity isokinetic short-duration leg exercise is effective for the maintenance of peak O2 (VO2) uptake and muscular strength and endurance, respectively, during 30 days of -6 deg head-down bed rest deconditioning. The results show no significant changes in leg peak torque, leg mean total work, arm total peak torque, or arm mean total work for members of the isotonic, isokinetic, and controls groups. Changes are observed, however, in peak VO2 levels. The results suggest that near-peak variabile intensity, isotonic leg excercise maintains peak VO2 during 30 days of bed rest, while peak intermittent, isokinetic leg excercise protocol does not. R.B.

A90-17942
HEMODYNAMIC RESPONSES TO ACUTE HYPOXIA, HYPOBARIA, AND EXERCISE IN SUBJECTS SUSCEPTIBLE TO HIGH-ALTITUDE PULMONARY EDEMA
AKIRA KAWASHIMA, KEISHI KUBO, TOSHIO KOBAYASHI, and MORIE SEKIGUCHI (Shinshu University, Matsumoto, Japan) Journal of Applied Physiology (ISSN 0161-7567), vol. 67, Nov. 1989, p. 1982-1989. refs
(Contract MOESC-61480194; MOESC-61570371; MOESC-62480203)
Copyright

A90-17943
OPERATION EVEREST II - COMPARISON OF FOUR INSTRUMENTS FOR MEASURING BLOOD O2 SATURATION
VINCENT A. FORTE, JR., MARK K. MALCONIAN, RICHARD L. BURSE, PAUL B. ROCK, PATRICIA M. YOUNG (U.S. Army, Research Institute of Environmental Medicine, Natick, MA; McMaster University, Hamilton, Canada; Vermont, University, Burlington) et al. Journal of Applied Physiology (ISSN 0161-7567), vol. 67, Nov. 1989, p. 2135-2140. refs
(Contract DAMD17-85-C-5206; NIH-HL-14985; NIH-HL-17731)
Copyright

A study of hypobaric hypoxia is used to study the bias and precision of four methods for the determination of O2 saturation. The O2 saturation of arterial and mixed venous blood samples of seven subjects exposed to simulated altitudes from sea level to 8.840 m are compared. These measurements were made the Instrumentation Laboratory 282 CO-oximeter, the Radiometer ABL-300, and the Lex-O2-ConK. Noninvasive measurements of arterial O2 saturation were made with a Hewlett-Packard 47201A ear oximeter. The results from these methods are compared. R.B.

A90-18125
EQUIPMENT AND METHODS FOR STUDYING THE OPERATOR'S PERFORMANCE [APPARATURA I METODY ISSLEDOVANIIA DEIATEL'NOSTI OPERATORA]
A. A. FROLOV, ED. Moscow, Izdatel'stvo Nauka, 1989, 112 p. In Russian. No individual items are abstracted in this volume.
Copyright

The papers contained in this volume cover a wide range of problems related to the analysis of the functions, performance, and reliability of the human operator. The discussion covers hardware solutions for the recording of slow processes; modeling of the functional asymmetry of the brain using hypnosis; psychophysical characteristics of the interaction between two operators; and Hilbert filtration of harmonic biosignals. Papers are also presented on the entropy analysis of variable functional states; transition processes in the parameters of the eye lid motor response in the evaluation of various functional states; and the use of potential averaging within narrow response time intervals for the analysis of the operator's performance. V.L.

A90-18582#
A TWO-DIMENSIONAL MATHEMATICAL MODEL OF HUMAN THERMOREGULATION FOR PERSONAL THERMAL CONDITIONING WITH WATER COOLING
XIUGAN YUAN, BIN SHA, and JUNQING WANG (Beijing University of Aeronautics and Astronautics, People's Republic of China) Acta Aeronautica et Astronautica Sinica (ISSN 1000-6893), vol. 10, May 1989, p. A242-A248. In Chinese, with abstract in English. refs

In this paper, a new two-dimensional mathematical model of human thermoregulation for personal thermal conditioning with water cooling is developed. This model can be used to predict transient temperature response for a human in a nonuniform hot environment, doing different jobs and dressing in different clothes. This model can also evaluate the time within which man can work effectively in a hot environment. In addition, this model can

be used for the optimum design and evaluation of personal thermal conditioning systems. Author

A90-18619#
CHANGE OF HUMAN TRACKING ABILITY UNDER +G(Y) STRESS
BAOSHENG XIE, ZHENYONG XU, HUAYING XU, and GUANGYUAN LIU (Institute of Space Medico-Engineering, Beijing, People's Republic of China) Acta Aeronautica et Astronautica Sinica (ISSN 1000-6893), vol. 10, July 1989, p. A394-A398. In Chinese, with abstract in English.

Five young male subjects (18-23 yrs) were exposed to +G(y) stress and were tested for two-dimensional tracking performance on a human centrifuge of 12-meter radius. Some physical parameters such as tracking error, output signal of side-arm controller and input signal of the compensatory tracking system and physiological parameters such as EEG and EMG were recorded. Methods of system identification and statistics were used for data processing. It was found that subjects' mean tracking error and controlling efficiency decrease and human operating dynamic parameters such as mean-gain effective-delay time and frequency of tracking motion are changed with increase of G value and brain load. Result of analysis showed that the cause of decrease in human tracking ability may be related to arm biomechanic effect and changes of brain function under +G(y) stress. Author

A90-19125* Massachusetts Univ., Worcester.
AN AUTOANALYZER TEST FOR THE QUANTITATION OF PLATELET-ASSOCIATED IGG
NATHAN LEVITAN, RICHARD A. TENO, and IRMA O. SZYMANSKI (Massachusetts, University, Worcester) Vox Sanguinis (ISSN 0042-9007), vol. 51, 1986, p. 127-132. refs
(Contract NAS9-17222)
Copyright

A new quantitative antiglobulin consumption (QAC) test for the measurement of platelet-associated IgG is described. In this test washed platelets are incubated with anti-IgG at a final dilution of 1:2 million. The unneutralized fraction of anti-IgG remaining in solution is then measured with an Autoanalyzer and soluble IgG is used for calibration. The dose-response curves depicting the percent neutralization of anti-IgG by platelets and by soluble IgG were compared in detail and found to be nearly identical, indicating that platelet-associated IgG can be accurately quantitated by this method. The mean IgG values were 2287 molecules/platelet for normal adults and 38,112 molecules/platelet for ITP patients. The Autoanalyzer QAC test is a sensitive and reproducible assay for the quantitation of platelet-associated IgG. Author

A90-19726#
SPACE CONSTRUCTION - MICRO-GRAVITY AND THE HUMAN ELEMENT
RICHARD JOHNSON (Colorado, University, Boulder) AIAA, Aerospace Sciences Meeting, 28th, Reno, NV, Jan. 8-11, 1990. 7 p. refs
(AIAA PAPER 90-0184) Copyright

Future space construction missions will involve both human and machine constructors. Selection of the optimum constructor mix requires a model of constructor capabilities and requirements. Obtaining data on the capabilities and requirements of humans in microgravity is a major part of that effort. Data searches have resulted in first-cut estimates of human constructor micro-g stay durations and work effectiveness. The current best stay duration limit is 180 days, while work effectiveness is approximately 20 percent less than on the earth's surface. Author

N90-13918# SRI International Corp., Menlo Park, CA. Sensory Sciences Research Lab.
ROLE OF RETINOCORTICAL PROCESSING IN SPATIAL VISION Annual Report No. 2, 1 May 1988 - 1 May 1989
DONALD H. KELLY Jun. 1989 35 p
(Contract F49620-87-K-0009; AF PROJ. 2313)
(AD-A210995; AFOSR-89-1027TR) Avail: NTIS HC A03/MF A01 CSCL 23/3

The inhomogeneous retinal filtering algorithms is incorporated into a more general model that includes conformal projection of the retinal filtered outputs into cortical input images, suitable for further processing, such as Gabor filtering. The new cortical images seem to show much less loss of information relative to the retina. No longer is restored some of the dc (zero frequency) component that is filtered out by the (Laplacian/Gaussian) retinal receptive-field model. Both right and left hemisphere images are provided, joined at the fovea for easy comparison with the corresponding retinal image. Study of these cortical images is yielding new insights. Peripheral objects, while remaining otherwise relatively undistorted, will be rotated either clockwise or counterclockwise as for as + or - 90 deg in cortical coordinates if they lie above or below the horizontal meridian. This is consistent with other cortical image models, but it does not bode well for the possibility of creating a stable frame by any known array-processing operation on cortical outputs. Modeling cortical filtering, as by Gabor functions, was examined. It is already clear that a simple, linear convolution without further refinements is not a good model for this process. GRA

N90-13919# Army Aeromedical Research Lab., Fort Rucker, AL. Sensory Research Div.
EVALUATION OF SPEECH INTELLIGIBILITY THROUGH A BONE CONDUCTION STIMULATOR Final Report
TED L. LANGFORD, BEN T. MOZO, and JAMES H. PATTERSON, JR. Jul. 1989 21 p
(AD-A212002; USAARL-89-13) Avail: NTIS HC A03/MF A01 CSCL 20/1

The intelligibility of speech, delivered via a bone-conduction transducer, was measured under simulated combat vehicle noise conditions and compared with the same measurements made with a conventional, air-conduction system. The measurements were made for conditions in which the ear canals were open and in which they were occluded with protective earplugs. The use of the bone-conduction system led to a 25.3-dB improvement over the conventional air-conduction system. GRA

N90-13920# California Univ., Irvine. Public Policy Research Organization.
PILOT INVESTIGATION OF INDOOR-OUTDOOR AND PERSONAL PM10 (THORACIC) AND ASSOCIATED IONIC COMPOUNDS AND MUTAGENIC ACTIVITY Final Report, Feb. 1987 - Apr. 1989
STEVEN D. COLOME, NORMAN Y. KADO, MICHAEL KLEINMAN, and PETER JAQUES (New York Univ., New York.) 27 Apr. 1989 126 p
(Contract ARB-A6-129-87)
(PB89-222723; ARB-R-89/397) Avail: NTIS HC A07/MF A01 CSCL 06/19

A major objective of the pilot study was to evaluate methods of measuring indoor and personal exposures to PM10. Other objectives were to examine the feasibility of measuring particle characteristics (other than mass) that may be useful in relating exposures to PM10 to health effects. The investigators tested several types of particle sampling devices in the homes of eight asthmatic subjects who resided in Orange County. The investigators measured particle mass for levels of sulfate nitrate ions and the mutagenicity of particle extracts. The pilot study demonstrated successfully the use of certain portable sampling devices to measure PM10 exposure and showed that it is feasible to measure levels of ionic species and mutagenic activity in particle samples obtained with these devices. The results of the study can be applied in the design of larger studies of similar nature. Author

N90-13921# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
A PROTOTYPE MICROPROCESSOR BASED AUDIOMETER FOR USE BY THE CF (CANADIAN FORCES) MEDICAL SERVICES FOR PERIODIC HEARING TESTS
S. E. FORSHAW, P. C. ODELL, and R. B. CRABTREE May

1989 56 p
(AD-A212990; DCIEM-89-TR-19) Avail: NTIS HC A04/MF A01 CSCL 12/5

A prototype microcomputer-based audiometer designed to demonstrate the potential of such technology for routine periodic hearing testing in the Canadian Forces (CF) is demonstrated. Besides the microcomputer and its dual-disk drive, display screen and printer, the system is comprised of an interface box containing a crystal clock, frequency synthesizer, digital attenuator, electronic switch, audio amplifier, acoustic earphone calibrators, and patient-response interface circuitry. The threshold-detection paradigms are based on the modified Hughson and Westlake procedure. The associated software provides prompts to the technician for parameters and data for each patient (e.g., age, social insurance number (SIN), military occupation code (MOC)), along with prompts during the testing if problems are encountered. After a test is completed, the patient's CF hearing category is computed and displayed on the screen audiogram form, and the test results are stored automatically in a disk file for future reference. GRA

N90-13922# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
THE RELATIONSHIP BETWEEN SUBJECTIVE AND OBJECTIVE MEASURES OF SIMULATOR-INDUCED ATAXIA
L. KANTOR, L. E. MAGEE, and K. M. HAMILTON Jun. 1989 19 p
(AD-A213095; DCIEM-89-RR-28) Avail: NTIS HC A03/MF A01 CSCL 06/10

Flight simulator training sometimes leads to unwanted aftereffects commonly called simulator induced sickness. Subjective reports of simulator-induced sickness include loss of balance (ataxia), dizziness, nausea, headache, eyestrain, and general discomfort. Symptoms of balance loss are particularly worrisome because of their potential to compromise safety following simulator training. While the reason flight simulators produce ataxia in some aircrew is not clear, most investigators speculate that it is caused by readaptation of the human spatial orientation system to the real world following adaptation to the artificial environment provided by the simulator. Subjective reports of simulator-induced ataxia are difficult to corroborate using objective tests of balance. Two reasons for this are ceiling and practice effects that occur with objective tests of balance. An attempt was made to overcome these problems. Postural control was assessed subjectively following exposure to a general purpose flight simulator and objectively using four balance tests specifically designed to avoid celling effects. The experimental design was intended to control for practice. Subjective reports of disequilibrium following training were verified by only one of the balance tests; the Walk On Rail Eyes Open (WOREO) was reliable in showing loss of postural control. The results suggest that the WOREO should be used as an objective test for studying postural disequilibrium following simulator exposure. GRA

N90-13923# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
SIMULATOR INDUCED SICKNESS IN THE CP-140 (AURORA) FLIGHT DECK SIMULATOR
K. M. HAMILTON, L. KANTOR, R. HESLEGRAVE, L. E. MAGEE, and K. HENDY May 1989 25 p
(AD-A213096; DCIEM-89-RR-32) Avail: NTIS HC A03/MF A01 CSCL 06/10

Training on modern flight simulators can lead to a condition referred to as simulator induced sickness (SIS) which is characterized by nausea, dizziness and postural instability. It is believed that SIS results from exposure to conflicting sensory information. The present report examined the incidence, severity and duration of SIS as a function of flight experience and aircrew position (pilot/copilot) in 16 aircrew following training on the CP-140 (Aurora) Flight Deck Simulator at Canadian Forces Base Greenwood. The dependent measures included symptomatology and postural stability. In addition, measures of workload were taken to examine the contribution of the high task demands generally associated with simulator training to the development of SIS symptomatology. The results indicated that over 50 percent of tested aircrew experienced increases in symptom frequency following simulator training with the most commonly reported symptoms being mild mental fatigue, physical fatigue, eye strain and after sensations of motion. The workload results confirmed that the simulator imposed high task demands on the aircrew. Furthermore, the workload results were consistent with the pattern of symptoms observed, suggesting that factors other than sensory conflict may be involved in the development of symptomatology following simulator exposure. Future investigations should attempt to identify these factors so that SIS can be managed more effectively. GRA

N90-13924# California Univ., Berkeley.
COMPUTATIONAL AND PSYCHOPHYSICAL STUDY OF HUMAN VISION USING NEURAL NETWORKS Final Report, 1 Aug. 1985 - 31 Jan. 1989
DONALD A. GLASER and KUMAR TRIBHAWAN 28 Apr. 1989 66 p
(Contract N00014-85-K-0692; RR04209)
(AD-A213290) Avail: NTIS HC A04/MF A01 CSCL 06/4

The overall goal of our research program is to construct models of the human visual system that can be implemented on available computers and capture essential abilities of the real thing. These models should be useful in understanding how the human visual system works and for practical applications. In order to incorporate some of the known structural features of the brain in our models, we have chosen a neural net paradigm to mimic some aspects of the real nervous system. These networks contain nodes representing simplified nerve cells and can have an enormous variety of structures, some of which are the subjects of intensive study in many laboratories. Since so many different network structures are possible, it is necessary to use as much information as possible to limit the choice of nets to those most likely to be useful models of the human visual system. Our work in psychophysics is designed to provide limits on the choice of architectures for model nets by requiring them to satisfy certain general conditions indicated by these experiments. Several experimental projects will be described concerning perception of relative depth and motion. One generalization that emerges from all of them is that local visual judgements can be grossly influenced by information gleaned from quite distant parts of a scene. To mimic the operation of the human visual system, then, a neural net must collect information from sizeable areas of a scene and use it to influence outputs from local visual processes. GRA

N90-13925*# National Aeronautics and Space Administration, Washington, DC.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 330)
Dec. 1989 62 p
(NASA-SP-7011(330); NAS 1.21:7011(330)) Avail: NTIS HC A11; NTIS standing order as PB89-912300, $10.50 domestic, $21.00 foreign CSCL 06/5

This bibliography lists 156 reports, articles, and other documents introduced into the NASA Scientific and Technical Information System during November 1989. Subject coverage includes: aerospace medicine and psychology, life support system and controlled environments, safety equipment, exobiology and extraterrestrial life, and flight crew behavior and performance. Author

N90-13926*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
EXERCISE COUNTERMEASURES FOR BED REST DECONDITIONING
JOHN GREENLEAF, ed. Oct. 1989 58 p
(NASA-TM-101045; A-88315; NAS 1.15:101045) Avail: NTIS HC A04/MF A01 CSCL 06/19

The major objectives were to evaluate the efficiency of different modes of exercise (isotonic and isokinetic) for countering the effects of bed rest deconditioning on work capacity (peak oxygen

uptake), muscular strength, orthostatic tolerance, posture, equilibrium and gait; and to collect additional data of a more fundamental nature to help understand how these deconditioning responses occur. These data will be used for writing prescriptions for exercise to be utilized by astronauts for maintaining work capacity and well-being on Freedom Station, and to determine what exercise devices should be place in the station. Author

N90-13927# Centre d'Etudes et de Recherches de Medecine Aerospatiale, Paris (France).
PRELIMINARY STUDY OF PHARMACOLOGICAL CONTROL OF SPACE DISEASE [ETUDES PRELIMINAIRES AU CONTROLE PHARMACOLOGIQUE DU MAL DE L'ESPACE]
C. L. MILHAUD, D. P. LAGARDE, and G. FLORENCE 19 Dec. 1988 25 p In FRENCH
(Contract DRET-85-1032)
(ETN-90-95015) Avail: NTIS HC A03/MF A01

The design of experiments to implement simulations of low body positive pressure type using Macaque Rhesus animals is described. The same species was employed to study the standard induction of emetic syndromes caused by copper sulfate, Ipecac syrup and Ergotamine. The effects of the three substances on the Macaque Rhesus are characterized. ESA

N90-13928# Toulouse Univ. (France).
WATCHFULNESS AND ATTENTION DURING WEIGHTLESSNESS SIMULATIONS: USE OF COMPUTERIZED PSYCHOMETRIC TESTS Ph.D. Thesis [LA VIGILANCE ET L'ATTENTION AU COURS D'UNE SIMULATION PROLONGEE D'IMPESANTEUR: *UTILISATION D'UNE BATTERIE DE TESTS* PSYCHOMETRIQUES INFORMATISES]
ALAIN CORNAC 1989 116 p In FRENCH
(REPT-89-TOU-3-1045; ETN-90-95264) Avail: NTIS HC A06/MF A01

Psychometric analysis was carried out on four subjects for 30 days. The position of the body maintained the head 15 cm lower than the feet. This simulation technique allows reproduction of the hemodynamic effects observed in microgravity. Three of the four subjects were subjected to periods of decompression of the lower part of the body (low body negative pressure). The results do not allow positive or negative conclusions. The tests used are sensitive to learning phenomena. ESA

N90-14767 Temple Univ., Philadelphia, PA.
THE EFFECTS OF NONSELECTIVE AND SELECTIVE BETA BLOCKADE UPON NONSHIVERING THERMOGENESIS DURING AN ACUTE COLD EXPOSURE IN COLD ACCLIMATED MEN Ph.D. Thesis
KYRIAKOS M. EVRENOGLOU 1989 131 p
Avail: Univ. Microfilms Order No. DA8920240

The effects of nonselective and selective beta blockage upon nonshivering thermogenesis during an acute cold exposure in acclimated men was determined. Thermoregularity measurements were conducted in both a neutral (25 C) climate and a cold (5 C) climate. The data collected for each subject in each of the six experimental sessions consisted of heart rate (HR), oxygen consumption (VO2), core temperature (Tr), mean skin temperature (Ts), mean body temperture (Tb), shivering (EMG), and forearm blood flow (FBF). The experimental population consisted of four male subjects with a mean age of 18 and 22. All subjects were previously cold acclimated. Three drug treatments were employed in which each drug was given twice, once during the neutral exposure and the other during the cold exposure. Each subject was given either a placebo, propranolol, (1.05 mg/kg.wt), or atenolol (50 mg). Dissert. Abstr.

N90-14768# Food and Drug Administration, Rockville, MD. Center for Devices and Radiological health.
BIOLOGICAL EFFECTS OF HYPERTHERMIA AND POTENTIAL RISK ASSOCIATED WITH ULTRASONIC EXPOSURE
BENJAMIN R. FISHER Jul. 1989 30 p
(PB89-100702; FDA/CDRH-89/106) Avail: NTIS HC A03/MF A01 CSCL 06/19

The high intensities that have been reported in 510(k) applications for some diagnostic ultrasound devices, particularly pulsed Doppler cardiovascular units, cause concern about the safety of these devices. The average intensities of some of these devices approach the intensity levels used for therapeutic heating. This concern is further heightened by reports on the use of pulsed Doppler devices to monitor blood flow in the fetal heart, placenta, and ovarian umbilical vessels. The purpose of the report is to provide an overview of the potential biological consequences that may result from exposure to high temporal average ultrasound intensities. A thermal mechanistic approach is used for the analysis because: (1) thermal effects are the predominant consequence of high temporal average intensitites; (2) heating is the best understood mechanism of action of ultrasound; and (3) a thermal approach is supported by substantial data in the literature. Author

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BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

A90-16659* Anacapa Sciences, Inc., Santa Barbara, CA.
HABITABILITY DURING LONG-DURATION SPACE MISSIONS - KEY ISSUES ASSOCIATED WITH A MISSION TO MARS
JACK STUSTER (Anacapa Sciences, Inc., Santa Barbara, CA) IN: The case for Mars III: Strategies for exploration - General interest and overview. San Diego, CA, Univelt, Inc., 1989, p. 181-191.
(Contract NAS2-11690)
(AAS PAPER 87-191) Copyright

Isolation and confinement conditions similar to those of a long-duration mission to Mars are examined, focusing on 14 behavioral issues with design implications. Consideration is given to sleep, clothing, exercise, medical support, personal hygiene, food preparation, group interaction, habitat aesthetics, outside communications, recreational opportunities, privacy, waste disposal, onboard training, and the microgravity environment. The results are used to develop operational requirements and habitability design guidelines for interplanetary spacecraft. R.B.

A90-16660
CREW SELECTION FOR A MARS EXPLORER MISSION
BENTON C. CLARK (Martin Marietta Planetary Sciences Laboratory, Denver, CO) IN: The case for Mars III: Strategies for exploration - General interest and overview. San Diego, CA, Univelt, Inc., 1989, p. 193-203.
(AAS PAPER 87-192) Copyright

Issues related to the selection of crew members for a manned mission to Mars are discussed. The crew skills and character needed for a Mars mission are outlined and six basic types of crewmember skills needed for a mission are outlined. Consideration is given to the age and characteristics of crewmembers, safety, privacy, communication, and the issue of mission nomenclature. R.B.

A90-16661* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
HUMAN ASPECTS OF MISSION SAFETY
MARY M. CONNORS (NASA, Ames Research Center, Moffett Field, CA) IN: The case for Mars III: Strategies for exploration - General interest and overview. San Diego, CA, Univelt, Inc., 1989, p. 205-213. refs
(AAS PAPER 87-193) Copyright

Recent discussions of psychology's involvement in spaceflight have emphasized its role in enhancing space living conditions and incresing crew productivity. While these goals are central to space missions, behavioral scientists should not lose sight of a more basic flight requirement - that of crew safety. This paper

examines some of the processes employed in the American space program in support of crew safety and suggests that behavioral scientists could contribute to flight safety, both through these formal processes and through less formal methods. Various safety areas of relevance to behavioral scientists are discussed. Author

A90-17514
MARIJUANA, AGING, AND TASK DIFFICULTY EFFECTS ON PILOT PERFORMANCE
VON O. LEIRER, DANIEL G. MORROW (Stanford University, CA), and JEROME A. YESAVAGE (USVA, Medical Center, Palo Alto, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, Dec. 1989, p. 1145-1152. refs
(Contract NIH-DA-03593; NIH-2-R44-AG-06753-02)
Copyright

This study provides evidence that diverse factors can cumulatively contribute to human/machine performance decrements. In separate sessions, young and old pilots smoked one of three cigarettes containing either 0 mg, 10 mg, or 20 mg of the active ingredient, delta 9 THC. They flew a calm and a turbulent flight in a light aircraft simulator at 1, 4, 8, 24, and 48 hour (h) delay after smoking. Effects were found at 1 and 4 h after smoking in the turbulent flight conditions when 20 mg cigarettes were smoked. Drug dose level, age, weather conditions (i.e., task difficulty), and delay period all affected pilot performance. Most important, these variables produced cumulative performance decrements. Author

A90-17515
PSYCHOMOTOR SCREENING FOR USAF PILOT CANDIDATES - SELECTING A VALID CRITERION
RICHARD H. COX (Ball State University, Muncie, IN) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, Dec. 1989, p. 1153-1156. refs
Copyright

Subjects for this research were 153 prospective pilots who were tested on computerized versions of the two-hand coordination and complex coordination psychomotor tests. Independent variables included five basic error scores associated with the two psychomotor tests. The criterion for pilot performance was conceptualized as a function of the number of flying hours required to graduate from Undergraduate Pilot Training (UPTFLY). Results of MANOVA and multiple regression analyses revealed that performance on the two psychomotor tests was significantly related to the criterion for pilot performance (UPTFLY). The multiple regression analysis resulted in 27.1 percent of the variability of UPTFLY being accounted for by psychomotor performance. When the data were reanalyzed using a pass/fail UPT criterion, the variability accounted for remained high, suggesting an anomaly associated with sample selection. Undergraduate pilot training outcome (pass/fail) remains the most valid criterion for Undergraduate Pilot Training success. Author

N90-13929# SRI International Corp., Menlo Park, CA. Vision Research Program.
SPATIOTEMPORAL CHARACTERISTICS OF VISUAL LOCALIZATION, PHASE 2 Annual Report, Aug. 1988 - Aug. 1989
CHRISTINA A. BURBECK, DUANE K. BOWMAN, and YEN LEE YAP Aug. 1989 165 p
(Contract F49620-88-K-0008)
(AD-A212934; AFOSR-89-1246TR) Avail: NTIS HC A08/MF A01 CSCL 06/4

We have conducted psychophysical experiments to determine: (1) the contribution of local spatial filters to separation discrimination, and (2) the properties of mechanisms that enter into subsequent stages of spatial processing i.e., separation discriminators. The separation, eccentricity, spatial extent, exposure duration, and proximity of the targets to other objects were manipulated. The extent of the target was more important for discrimination of relatively small (rather than large) separations at any given eccentricity, supporting the idea that an additional stage beyond the local spatial filters is necessary to explain performance of separation discrimination. The proximity of other spatial features was found to affect thresholds only for briefly exposed targets, implying that subsequent mechanisms can select the frequency content of the information carried by the local spatial filters. Separation discrimination appeared to be performed by two different types of separation discriminators, one largely separation-dependent, and the other separation-independent but strongly eccentricity-dependent. Unlike the local spatial filters the separation discriminator processes information serially, with each separation taking at least 100 ms to encode. GRA

N90-13930# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Computer Science/Dept. of Interactive Systems.
THE STRUCTURAL MEMORY: A NETWORK MODEL FOR HUMAN PERCEPTION OF SERIAL OBJECTS
JANTIEN VANDERVEGT, HANS BUFFART, and CEES VANLEEUWEN Dec. 1988 24 p Submitted for publication Sponsored by the Psychon Foundation
(CWI-CS-R8829; ETN-90-95973) Copyright Avail: NTIS HC A03/MF A01

The Structural Memory, a network model for human perception of serial objects, is presented. Based upon the automatic generation of all representations, G (generation)-relations are defined between the representations, and S (structure)-relations are defined based on the structures described by the representations. The representations and the relations are seen as respectively the modes and the links in a network which is the basis for the Structural Memory. An activation value is assigned to each representation which expresses the strength of the preference for the described structure at a certain moment. A process model predicts strength of the preference for a perceptible structure in an object. Experiments are simulated with two of these process models. ESA

N90-13931*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
FUNCTIONAL DECOR IN THE INTERNATIONAL SPACE STATION: BODY ORIENTATION CUES AND PICTURE PERCEPTION
RICHARD G. COSS, YVONNE A. CLEARWATER, CHRISTOPHER G. BARBOUR, and STEVEN R. TOWERS (California Univ., Davis.) Nov. 1989 29 p
(NASA-TM-102242; A-89260; NAS 1.15:102242) Avail: NTIS HC A03/MF A01 CSCL 05/9

Subjective reports of American astronauts and their Soviet counterparts suggest that homogeneous, often symmetrical, spacecraft interiors can contribute to motion sickness during the earliest phase of a mission and can also engender boredom. Two studies investigated the functional aspects of Space Station interior aesthetics. One experiment examined differential color brightnesses as body orientation cues; the other involved a large survey of photographs and paintings that might enhance the interior aesthetics of the proposed International Space Station. Ninety male and female college students reclining on their backs in the dark were disoriented by a rotating platform and inserted under a slowly rotating disk that filled their entire visual field. The entire disk was painted the same color but one half had a brightness value that was about 69 percent higher than the other. The effects of red, blue, and yellow were examined. Subjects wearing frosted goggles opened their eyes to view the rotating, illuminated disk, which was stopped when they felt that they were right-side up. For all three colors, significant numbers of subjects said they felt right-side up when the brighter side of the disk filled their upper visual field. These results suggest that color brightness could provide Space Station crew members with body orientation cues as they move about. It was found that subjects preferred photographs and paintings with the greatest depths of field, irrespective of picture topic. Author

N90-13932# Plessey Research Roke Manor Ltd., Romsey (England).
A GUIDE TO REASONING UNDER UNCERTAINTY

D. A. FINDLAY Nov. 1987 13 p
(REPT-72/87/R486U; ETN-90-94847) Copyright Avail: NTIS HC A03/MF A01

Some aspects of reasoning under uncertainty are discussed. The analysis is structured around the sort of question a prospective reasoner under uncertainty is likely to ask. The situations where the reasoning under uncertainty arises are outlined. The meaning of uncertainty is established. The way of representing uncertainty in a self-consistent manner is considered. The treatments of the approximate and plausible reasoning are given. ESA

N90-13933# Technische Univ., Delft (Netherlands). Dept. of Aerospace Engineering.
COMPENSATORY TRACKING IN DISTURBANCE TASKS AND TARGET FOLLOWING TASKS. THE INFLUENCE OF COCKPIT MOTION ON PERFORMANCE AND CONTROL BEHAVIOR
J. C. VANDERVAART and R. J. A. W. HOSMAN Dec. 1987 55 p
(LR-511; ETN-90-95979) Avail: NTIS HC A04/MF A01

Manned, moving base simulator experiments showing improved tracking performance in disturbance tasks as well as in target following tasks when cockpit motion is added to a basic, visual, artificial horizon display are investigated. The experimental findings are clarified qualitatively and quantitatively by analysis of the differences of the two tasks in terms of classic control theory and by use of experimented data on vestibular motion perception previously obtained. ESA

N90-14769# Office of Naval Research, Arlington, VA.
COGNITIVE AND NEURAL SCIENCES DIVISION 1989 PROGRAMS Summary Report, 1 Oct. 1988 - 30 Sep. 1989
WILLARD S. VAUGHAN Sep. 1989 244 p
(AD-A212634; OCNR-114289-22) Avail: NTIS HC A11/MF A02 CSCL 05/8

Cognitive and Neural Sciences programs develop fundamental knowledge about human capabilities and performance characteristics which guide Navy and Marine Corps efforts to improve personnel assessments for selection and classification, training, equipment and system designs for human operation and maintenance. One goal is to provide scientific underpinning for more accurate prediction and enhancement of human performance in training and operational environments. A second goal is to understand the neurobiological constraints and computational capabilities of neural information processing systems for future device implementation. The Division has core programs in cognitive, perceptual and neural sciences which seek to understand human behavior at successively deeper levels of analysis. GRA

N90-14770# Lawrence Livermore National Lab., CA.
MIPS AND BIPS ARE MEGAFLOPS: LIMITS OF UNIDIMENSIONAL ASSESSMENTS
WILLIAM W. BANKS and MICHAEL PIHLMAN Jul. 1989 7 p Presented at the 33rd Annual Meeting of Human Factors Society, Denver, CO, 16-20 Oct. 1989
(Contract W-7405-ENG-48)
(DE89-015707; UCRL-101061-REV-1; CONF-8910155-2-REV-1) Avail: NTIS HC A02/MF A01

We believe that a failure to incorporate human performance measures into system test protocols will result in imprecise and incomplete data when attempting to estimate field test performance from a total systems perspective. Traditional methods of evaluating local area network (LAN) performance generally refer to the network's throughput, time delays, data rate (BIPS), or media access protocol efficiency. These measures are quite acceptable when determining point-to-point benchmark network performance but do not take into account the more global man-machine performance issues associated with people using network systems to perform tasks and execute functions concurrently within a total systems context. This paper experimentally compares differences in human productivity and efficiency while using: an existing data gathering system consisting of several geographically distributed, unconnected, and disparate mainframes; and a prototype Intelligent Gateway connecting mainframes and offering the user less complexity in procedure execution and an easy to use interface. Tests were conducted with volunteer users in a repeated measures experimental design. Each test subject was randomly assigned to each of two conditions and required to execute routine tasks with each of two systems. Analysis of variance (ANOVA) results revealed significant differences in task completion times and human error rates between the two systems. An increase in human productivity/efficiency was observed using the gateway LAN. We propose to extend the traditional computer performance measurement boundaries, which now encompass only the network hardware, to include an overall input-to-output LAN performance measure, combining both measures of user productivity and network performance. A discussion of trade-offs between unidimensional assessment methods using large sample sizes and multiple methods with small sample sizes is also presented. DOE

N90-14771# Los Alamos National Lab., NM.
WORKLOAD INDUCED SPATIO-TEMPORAL DISTORTIONS AND SAFETY OF FLIGHT
CHRISTOPHER L. BARRETT and SCOTT A. WEISGERBER (Naval Weapons Center, China Lake, CA.) 1989 19 p Presented at the Advisory Group for Aerospace Research and Development (AGARD) Meeting, Copenhagen, Denmark, 2-6 Oct. 1989
(Contract W-7405-ENG-36)
(DE89-016613; LA-UR-89-2895; CONF-8910208-1) Avail: NTIS HC A03/MF A01

A theoretical analysis of the relationship between cognitive complexity and the perception of time and distance is presented and experimentally verified. Complex tasks produce high rates of mental representation which affect the subjective sense of duration and, through the subjective time scale, the percept of distance derived from dynamic visual cues (i.e., visual cues requiring rate integration). The analysis of the interrelationship of subjective time and subjective distance yields the prediction that, as a function of cognitive complexity, distance estimates derived from dynamic visual cues will be longer than the actual distance whereas estimates based on perceived temporal duration will be shorter than the actual distance. This prediction was confirmed in an experiment in which subjects (both pilots and non-pilots) estimated distances using either temporal cues or dynamic visual cues. The distance estimation task was also combined with secondary loading tasks in order to vary the overall task complexity. The results indicated that distance estimates based on temporal cues were underestimated while estimates based on visual cues were overestimated. This spatio-temporal distortion effect increased with increases in overall task complexity. DOE

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

A90-16656 Life Systems, Inc., Cleveland, OH.
LIFE SUPPORT SYSTEM CONSIDERATIONS AND CHARACTERISTICS FOR A MANNED MARS MISSION
FEROLYN T. POWELL (Life Systems, Inc., Cleveland, OH) IN: The case for Mars III: Strategies for exploration - General interest and overview. San Diego, CA, Univelt, Inc., 1989, p. 135-155. Research supported by NASA and Life Systems, Inc. refs
(AAS PAPER 87-188) Copyright

Both the Low Earth Orbit (LEO) Space Station and future manned space missions require Environmental Control and Life Support Systems (ECLSS) that provide safe, comfortable environments in which humans can live and work. The ECLSS functions and requirements (performance and design load) for these missions are defined. Options for closing the ECLSS cycle are

discussed and the level of closure planned for the initial orbital capability (IOC) Space Station are quantified. The impacts of the remaining ECLSS expendables on advanced missions are discussed. Also discussed are the new ECLSS requirements related to generation of food (via plants, animals and/or fish). The paper focuses on the ECLSS design drivers associated with a manned Mars mission. These drivers include environmental, operational and interface drivers. Characteristics of the IOC Space Station ECLSS are given to provide a quantitative feeling of the magnitude of the ECLSS for a Mars mission. Author

A90-17401
ANNUAL SAFE SYMPOSIUM, 26TH, LAS VEGAS, NV, DEC. 5-8, 1988, PROCEEDINGS
Symposium sponsored by the SAFE Association. Newhall, CA, SAFE Association, 1989, 330 p. For individual items see A90-17402 to A90-17439.

The present conference on advancements in the field of aerospace safety technologies discusses hypoxia symptoms due to various gas mixtures at high altitude, audiovisual ultrasonic monitoring of altitude decompression sickness, the development of a rocket-extraction escape system for the Space Shuttle, aircraft landing gear integrity, the effects of differently scheduled positive pressure breathing on G-level tolerance, and an onboard oxygen-generation system for a training aircraft. Also discussed are a pronated escape system for fighter aircraft, aft-facing transport aircraft passenger seat behavior under 16-G dynamic crash simulation conditions, a new-generation flight suit, a G(z)-sensitive automatic reclination pilot's seat, man-ratings for human centrifuges, spectra high-performance fibers for parachutes, visual dominance training, and the history of G-suit inflation rates. O.C.

A90-17406
TEST AND EVALUATION OF THE HYMATIC RODDITCH ANTI-G VALVE
LARRY J. MEEKER (USAF, School of Aerospace Medicine, Brooks AFB, TX) and ARNOLD G. KRUEGER (Krug International Corp., Technology Services Div., San Antonio, TX) IN: Annual SAFE Symposium, 26th, Las Vegas, NV, Dec. 5-8, 1988, Proceedings. Newhall, CA, SAFE Association, 1989, p. 32-35. refs

Improving G-protection in high performance aircraft continues to receive high priority at the USAF School of Aerospace Medicine (USAFSAM). Because the anti-G valve is an integral part of the current operational G-protection system, efforts to improve its function are continuing. To this end, unmanned test and evaluation of a new developmental anti-G valve was accomplished using the USAFSAM centrifuge. A specially designed bladder was used to simulate the volumes of an operational anti-G suit. Pressures were measured at the valve outlet and within the bladder using a catheter. Sixteen different combinations of G-onset rate, G-suit volume, G-suit pressure, and valve angle with G-vector were used to obtain these data. G-level versus G-onset rate, air flow and G-suit pressure are presented and compared to previous data obtained from the standard Alar anti-G valve and Alar High-Flow anti-G valve. Author

A90-17420
SYSTEM ENGINEERING APPLIED TO THE AIRCREW EYE/RESPIRATOR PROTECTION (AERP) PROGRAM
EDWARD H. THRUSH (Boeing Co., Seattle, WA) IN: Annual SAFE Symposium, 26th, Las Vegas, NV, Dec. 5-8, 1988, Proceedings. Newhall, CA, SAFE Association, 1989, p. 171-175.

The generic 'system engineering' process that has been applied to the design for the present Aircrew Eye/Respiratory Protection system can be characterized as the process of design and performance requirement definition/documentation, interface requirement definition, verification implementation, and verification analysis. The goal for Price Item Development Specifications and for Critical Items Specifications requirements was to define a worst-case in which satisfactory performance would guarantee general qualification for a component. O.C.

A90-17424
THE NEW GENERATION FLIGHT SUIT
MARIAN P. FAILE (Hoechst Celanese Corp., Charlotte, NC) IN: Annual SAFE Symposium, 26th, Las Vegas, NV, Dec. 5-8, 1988, Proceedings. Newhall, CA, SAFE Association, 1989, p. 192-196.

A new military flight suit fabric featuring improved flame and thermal protection, reduced heat stress, and permanent antistatic protection is now commercially available. This unique fabric, which meets and/or exceeds Military C-8349A requirements, is woven with (PBI)/Nomex/stainless steel fiber and represents the first flight suit material improvement in 20 years. As part of the PBI/Nomex/stainless steel flight suit fabric qualification testing, JP-4 fuel pit flame tests were conducted at Naval Air Development Center, Warminster, Pennsylvania. Body burns were reduced by 50 percent with PBI blend flight suits, as compared with Nomex flight suits. Testimonials from various wear trial participants confirmed the improved comfort and reduced heat stress of the PBI blend garments. An addition of 1 percent stainless steel in the fiber blend provides durable antistatic protection that lasts for the life of the garment. The paper discusses the improved PBI/Nomex/stainless steel flight suit fabric. Detailed test results describing superior flame protection, comfort and antistatic properties are addressed. Author

A90-17427
GZ SENSITIVE AUTOMATIC RECLINING AIRCREWMEMBER SEAT
TOM ZENOBI (U.S. Navy, Naval Air Development Center, Warminster, PA) IN: Annual SAFE Symposium, 26th, Las Vegas, NV, Dec. 5-8, 1988, Proceedings. Newhall, CA, SAFE Association, 1989, p. 210-215. refs

An investigation into reposition methods and power requirements for Gz sensitive automatic reclining of aircrew-members led to the development and testing of two different automatic reclining seat concepts: the tilt-back seat and the electrohydraulic automatic reclining PALE (Pelvis and leg elevating) seat. The tilt-back seat uses acceleration (Gz) force-induced actuation to tilt the test subject and seat structure backwards about a pivot point under the seat. The PALE seat uses an automatic electrohydraulic repositioning system to supinate the test subject by elevating his pelvis and legs while maintaining a fixed head (design eye) position. Human centrifuge testing has demonstrated a typical relationship between Gz tolerance and seat back angle (SBA): for the tilt-back seat, a 67 deg SBA occurred at approximately 2.4 to 3.4 Gz; For the PALE seat, supination began at 2.5 Gz with SBA increasing proportionally to Gz up to a maximum of 65 deg attained at 6.0 Gz and above. C.E.

A90-17434
ANTI-G SUIT INFLATION RATES - AN HISTORICAL OVERVIEW
R. E. VAN PATTEN (USAF, Harry G. Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN: Annual SAFE Symposium, 26th, Las Vegas, NV, Dec. 5-8, 1988, Proceedings. Newhall, CA, SAFE Association, 1989, p. 270-275. refs

A development history is presented for the inflation rates deemed most effective for aircrew anti-G suits from the 1940s to the present. The period from 1944 to 1973 was primarily concerned with fundamental research. By 1961, anti-G suits and their valves and inflation rate characteristics had reached the form they essentially possess at present; the recent development of such high-performance aircraft as the F-15 and F-16 has prompted intensive research on suit design and inflation schedules to cope with more severe aircrew operational requirements. Attention is

presently given to contradictory data obtained by researchers in this field in the 1980s. C.E.

A90-17435
ARMY AIRCREW EYE PROTECTION AGAINST LASER RADIATION AND BALLISTIC FRAGMENTS
HERBERT E. LEE (U.S. Army, Aviation Systems Command, Saint Louis, MO) IN: Annual SAFE Symposium, 26th, Las Vegas, NV, Dec. 5-8, 1988, Proceedings. Newhall, CA, SAFE Association, 1989, p. 276-280. refs
Copyright

Issues of ocular susceptibility/vulnerability from laser radiation and ballistic fragments on the battlefield are addressed, along with the status and merits of near-term protection. Interim modular protection must be fabricated and made for field use. Near-term protection for the human eye will reduce the number of ocular casualties if implemented. New technical approaches must be pursued to meet the changing laser protection requirements posed by multiwavelength and frequency agile laser systems. Interim solutions, both protective eyewear and operational doctrine, must be implemented in the near term to assure readiness. The present use of laser bioeffects data has been in the establishment of laser safety standards. C.E.

A90-17436
DEVELOPMENT OF AN ADVANCED HIGH ALTITUDE FLIGHT SUIT
JOHN DAMRON, TREVOR P. HOWARD (ILC Dover, Inc., Frederica, DE), TOM R. MORGAN, and ROBERT S. HOSKINS (USAF, Human System Div., Brooks AFB, TX) IN: Annual SAFE Symposium, 26th, Las Vegas, NV, Dec. 5-8, 1988, Proceedings. Newhall, CA, SAFE Association, 1989, p. 281-285.
Copyright

The Advanced High Altitude Flight Suit (AHAFS) was conceived and fabricated by modifying technologies proven on NASA's Apollo and Shuttle programs to maintain pressurized performance while optimizing performance in long term unpressurized wear. Originally designed for long term uninflated wear as emergency decompression protection in pressurized aircraft cockpits, the suit was improved to achieve better mobility in the pressurized state. Proper balancing of wall tensions across double axis 'soft joints' has resulted in lower suit loads, increased mobility, and established the feasibility at a higher suit operating pressure (5 psi). The AHAFS demonstrates that greater utility, comfort, and higher standards of decompression sickness protection can be attained by systematic attention to pressure suit joint design. C.E.

A90-17437
ANALYSIS OF THE THREAT AND DEVELOPMENT OF PROPOSED REQUIREMENTS FOR NAVAL AND MARINE CORPS EXTREME COLD WEATHER AIRCREW CLOTHING AND SURVIVAL EQUIPMENT
SUZANNE M. REEPS, TARA M. LARSON, and JONATHAN W. KAUFMAN (U.S. Navy, Naval Air Development Center, Warminster, PA) IN: Annual SAFE Symposium, 26th, Las Vegas, NV, Dec. 5-8, 1988, Proceedings. Newhall, CA, SAFE Association, 1989, p. 286-295. refs
Copyright

The Operational Requirement for Cold Water Protection (OR W1159-SL), which was issued in February 1979, established an important precedent in providing Navy guidelines for cold water exposure protection. It was based on Naval Safety Center accident data and anticipated SAR times which were accurate at that time. However, with the increased emphasis and likelihood of Naval and USMC operations occurring in northern regions, there is a need to update the Operational Requirement to include both cold water protection for longer duration survival and dry cold protection for survival in cold land/ice scenarios. This paper discusses anticipated personal protection needs based on an assessment of the most likely future operational environment(s) and the anticipated SAR capabilities for these regions in wartime. It also addresses the mission specific in-flight profiles, emergency needs, and the resulting physiological impact on aircrew assigned to the various aircraft in these regions of deployment. Author

A90-17438
RECONFIGURED LAP RESTRAINT OFFERS TOLERANCE INCREASE IN +GZ ACCELERATION
WILLIAM H. MUZZY, III, NORMAN S. GILBERT (U.S. Navy, Naval Biodynamics Laboratory, New Orleans, LA), and RUSSELL C. GRUNSTEN (New Orleans, Orthopedic Associates, LA) IN: Annual SAFE Symposium, 26th, Las Vegas, NV, Dec. 5-8, 1988, Proceedings. Newhall, CA, SAFE Association, 1989, p. 305-307.
Copyright

During a series of +Z whole-body indirect impact acceleration tests on the Naval Biodynamics Laboratory's Horizontal Accelerator, human volunteer subjects experienced lower back pain lasting more than a day, after tests when the acceleration levels reached 8-10 g. The lap belt portion of the restraint system was reconfigured to prevent the subject's pelvis from rotating forward during acceleration. A second series of +Z experiments was conducted using a new pelvic restraint with a different group of subjects. This modification allowed the tests to continue to 12 g with no recurrence of lower back problems. Author

A90-17439
TEST AND ADJUSTMENT OF SMOKE-PROTECTION EQUIPMENT FOR AIRCREW
HENRI MAROTTE, DAMIEN LEJEUNE, MARTINE KERGUELEN (Centre d'Essais en Vol, Laboratoire de Medecine Aerospatiale, Bretigny-sur-Orge, France), and RICHARD ZAPATA (L'Air Liquide, Sassenage, France) IN: Annual SAFE Symposium, 26th, Las Vegas, NV, Dec. 5-8, 1988, Proceedings. Newhall, CA, SAFE Association, 1989, p. 309-311, 312-318.
Copyright

Smoke protection equipment has been developed for civil aircraft cabin aircrew in compliance with regulations. The equipment is designed according to the principle of semiopen circuit respiratory systems. The existence of added ventilatory deadspace was assessed theoretically, then by analogy on a respiratory simulator, and finally on human subjects. The equipment provides a good level of protection against accidental contamination. C.D.

A90-17718* National Aeronautics and Space Administration, Washington, DC.
RADIATION HAZARDS IN LOW EARTH ORBIT, POLAR ORBIT, GEOSYNCHRONOUS ORBIT, AND DEEP SPACE
PERCIVAL D. MCCORMACK (NASA, Life Sciences Div., Washington, DC) IN: Working in orbit and beyond: The challenges for space medicine. San Diego, CA, Univelt, Inc., 1989, p. 59-78. refs
(AAS PAPER 87-159) Copyright

The predicted doses to the blood forming organs and skin of spacecraft crews in low inclination at high inclination and polar orbits, in LEO and in free space are reviewed. Doses from trapped solar radiation and galactic cosmic radiation are covered, and also those to be expected from anomalous, large solar particle events. They are compared with the maximum annual and career doses laid down by the National Council on Radiation protection (1987). The effect of spacecraft and space suit shielding is also considered. Space Shuttle flights have allowed extensive comparison of predicted doses with those measured experimentally. This has revealed some defects in the radiation and magnetic fields models used and has led to extensive reexamination of these models. Author

A90-17720* National Aeronautics and Space Administration, Washington, DC.
CONSIDERATION FOR SOLAR SYSTEM EXPLORATION - A SYSTEM TO MARS
ARNAULD E. NICOGOSSIAN (NASA, Life Sciences Div., Washington, DC) and VICTORIA GARSHNEK (George Washington University, Washington, DC) IN: Working in orbit and beyond: The challenges for space medicine. San Diego, CA, Univelt, Inc.,

1989, p. 101-110. refs
(AAS PAPER 87-163) Copyright

Biomedical issues related to a manned mission to Mars are reviewed. Consideration is given to cardiovascular deconditioning, hematological and immunological changes, bone and muscle changes, nutritional issues, and the development of physiological countermeasures. Environmental issues are discussed, including radiation hazards, toxic chemical exposure, and the cabin environment. Also, human factors, performance and behavior, medical screening of the crew, disease prediction, and health maintenance are examined. R.B.

A90-17778#
A STUDY OF THE APPLICATION OF VISUAL AND BEHAVIORAL PROPERTIES TO IMAGE DISPLAY SYSTEMS
HIDETOSHI NONAKA and TSUTOMU DA-TE Hokkaido University, Faculty of Engineering, Bulletin (ISSN 0385-602X), Oct. 1989, p. 83-89. In Japanese, with abstract in English. refs

An image display system with properties of binocular vision and motor vision has been developed which enables users to obtain three-dimensional information tbrough a single video monitor in real time. The binocular vision is realized by means of two video cameras and a pair of liquid crystals, and the motor vision is realized by means of a stepping-motor and supersonic sensors. The geometric distortions involved and their reduction are discussed. C.D.

A90-17835
HIDDEN DEPENDENCE IN HUMAN ERRORS
C. MICHAEL LEWIS (Pittsburgh, University, PA) and WILLIAM WREN STINE (New Hampshire, University, Durham) IEEE Transactions on Reliability (ISSN 0018-9529), vol. 38, Aug. 1989, p. 296-300. refs
Copyright

Two methodological refinements to the technique for human error rate prediction (THERP) for adjusting predictions to accommodate unconsidered sources of dependency are presented. The first is synchrony adjustment estimates dependencies among errors due to cyclical patterns in performing otherwise unrelated activities. Synchrony adjustments would also be appropriate for modeling repairs and component burn-in in systems which are operated in a cyclical fashion. The second is common rate adjustment adjusts estimates for multiple errors within an activity to make them consistent with the THERP assumptions about the distribution of error rates. Synchrony adjustment can result in substantial increases in the estimate of joint unavailability. While the effects of rate adjustment are less dramatic they suggest that the probability of events involving very many errors is higher than anticipated. Solutions to these two problems are presented along with numerical examples. I.E.

A90-17836
OBJECTIVE AND SUBJECTIVE ESTIMATES OF HUMAN ERROR
NEVILLE MORAY (Illinois, University, Urbana) IEEE Transactions on Reliability (ISSN 0018-9529), vol. 38, Aug. 1989, p. 301-304. refs
Copyright

It is shown that if subjective estimates of probabilities of events are to be converted to objective estimates by means of one or two empirical anchors, a currently recommended equation can produce meaningless values of probability which exceed unity. This new method guarantees rescaling to keep probability in the range (0,1). An example is given to demonstrate the approach. I.E.

A90-19919*# Massachusetts Inst. of Tech., Cambridge.
HAZARD EVALUATION AND OPERATIONAL COCKPIT DISPLAY OF GROUND-MEASURED WINDSHEAR DATA
CRAIG WANKE and R. JOHN HANSMAN, JR. (MIT, Cambridge, MA) AIAA, Aerospace Sciences Meeting, 28th, Reno, NV, Jan. 8-11, 1990. 15 p. Research supported by MIT and FAA. refs
(Contract NGL-22-009-640; NAG1-690)
(AIAA PAPER 90-0566) Copyright

Information transfer issues associated with the dissemination of wind shear alerts from the ground are studied. The two issues specifically addressed are the effectiveness of different cockpit presentations of ground-measured information and the assessment of the wind shear hazard from ground-based measurements. A pilot survey has produced an information base for study of crew-centered wind shear alert design. A part-task Boeing 767 'glass cockpit' simulation has provided useful data about modes of cockpit information presentation for both wind shear alert and ATC clearance delivery. Graphical map displays are observed to be exceptionally efficient for presentation of position-critical alerts, while some problems with text displays are identified. Problems associated with hazard assessment of ground-measured wind shear information are also identified. S.A.V.

A90-19945*# Fairchild Space Co., Germantown, MD.
MANNED MARS MISSION ON-ORBIT OPERATIONS METRIC DEVELOPMENT
BARNEY F. GORIN (Fairchild Space Co., Germantown, MD) AIAA, Aerospace Sciences Meeting, 28th, Reno, NV, Jan. 8-11, 1990. 7 p.
(Contract NAS5-30189)
(AIAA PAPER 90-0612) Copyright

This report describes the effort made to develop a scoring system, or metric, for comparing astronaut Extra Vehicular Activity with various robotic options for the on-orbit assembly of a very large spacecraft, such as would be needed for a Manned Mars Mission. All trade studies comparing competing approaches to a specific task involve the use of some consistent and unbiased method for assigning a score, or rating factor, to each concept under consideration. The relative scores generated by the selected rating system provide the tool for deciding which of the approaches is the most desirable. Author

N90-13934*# Life Systems, Inc., Cleveland, OH.
REFURBISHMENT OF ONE-PERSON REGENERATIVE AIR REVITALIZATION SYSTEM Final Report, 22 Jul. 1985 - 3 Apr. 1989
FEROLYN T. POWELL Mar. 1989 24 p
(Contract NAS8-36435)
(NASA-CR-183757; NAS 1.26:183757; LSI-TR-875-9) Avail: NTIS HC A03/MF A01 CSCL 05/8

Regenerative processes for the revitalization of spacecraft atmospheres and reclamation of waste waters are essential for making long-term manned space missions a reality. Processes studied include: static feed water electrolysis for oxygen generation, Bosch carbon dioxide reduction, electrochemical carbon dioxide concentration, vapor compression distillation water recovery, and iodine monitoring. The objectives were to: provide engineering support to Marshall Space Flight Center personnel throughout all phases of the test program, e.g., planning through data analysis; fabricate, test, and deliver to Marshall Space Flight Center an electrochemical carbon dioxide module and test stand; fabricate and deliver an iodine monitor; evaluate the electrochemical carbon dioxide concentrator subsystem configuration and its ability to ensure safe utilization of hydrogen gas; evaluate techniques for recovering oxygen from a product oxygen and carbon dioxide stream; and evaluate the performance of an electrochemical carbon dioxide concentrator module to operate without hydrogen as a method of safe haven operation. Each of the tasks were related in that all focused on providing a better understanding of the function, operation, and performance of developmental pieces of environmental control and life support system hardware. Author

N90-13935 Wisconsin Univ., Madison.
MEASUREMENT OF MECHANICAL WORK AND ENERGY EXPENDITURE IN RUNNING AND BICYCLING Ph.D. Thesis
DAVID ROBINSON BASSETT, JR. 1988 148 p
Avail: Univ. Microfilms Order No. DA8824082

Three objectives are fulfilled: to quantitate the differences in oxygen uptake (VO2) and mechanical work in level versus uphill

running; to propose two refinements for measuring external power output during the Wingate Anaerobic Test (WAT); and to evaluate the metabolic and thermoregulatory responses to skin wetting during running. Seven males performed overground (OG) and treadmill (TM) running at two grades (0 and 5 percent) over a range of speeds between 136 to 286 m/min. No significant differences were found between the VO2 of TM vs overground running at either of the grades examined. In a subsequent study, 8 males ran at 188 m/min at 0, 5, 10, and 15 percent grades. Internal work, measured by the link segment approach, decreased with increasing grades. The WAT is a 30 s test of external power output performed on a cycle ergometer. Since flywheel (FW) velocity decreases over the course of the test, kinetic energy stores contribute to the total power output. Correcting for this factor lowered peak power, mean power, and percent fatigue by 6.2, 3.0, and 6.6 percent, respectively in 8 male subjects. The measurement of external power output using a Monark 864 weight ergometer was found to require the placement of a load cell in series with the FW belt. During distance running, the total energy expenditure results in heat production, since no net external work is done. The responses to this treatment during a 2 hr run were examined under two different humidity conditions. Spraying had no effect on rectal temperature, heart rate, VO2, sweat loss, or percent change in plasma volume. Dissert. Abstr.

N90-13936# Air Force Wright Research and Development Center, Wright-Patterson AFB, OH.
CONFERENCE PROCEEDINGS OF THE HUMAN-ELECTRONIC CREW: CAN THEY WORK TOGETHER
JERRY EMERSON, ed., JOHN REISING, ed., ROBERT M. TAYLOR, ed., and MICHAEL REINECKE, ed. Jul. 1989 171 p Conference held in Ingolstadt, Fed. Republic of Germany, 19-22 Sep. 1988; sponsored by AFWAL, Royal Air Force Inst. of Aviation Medicine, Flugmedizinisches Inst. der Luftwaffe and Air Force European Office of Aerospace Research and Development
(AD-A211871; WRDC-TR-89-7008) Avail: NTIS HC A08/MF A01 CSCL 23/2

Advances in artificial intelligence (AI) will enable future fighter/attack aircraft to have a rather unique crew -- one human and one electronic. The objective of the workshop was to bring together AI specialists and cockpit designers in order to exchange ideas relative to: (1) the state of the art in aircraft applications of AI technology; and (2) the impact on the cockpit of the human/electronic crew. This meeting provided a valuable forum for the experts of several countries to exchange ideas, concepts, and data relative to hardware and software capabilities that can be included in an aircraft system design to aid the human operator in performing the mission. GRA

N90-13937# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
TEST PROCEDURES FOR THE EVALUATION OF HELMET AND HEADSET MOUNTED ACTIVE NOISE REDUCTION SYSTEMS
STANLY E. FORSHAW, JULIA M. RYLANDS, and R. B. CRABTREE Feb. 1989 22 p
(AD-A212991; DCIEM-89-TR-24) Avail: NTIS HC A03/MF A01 CSCL 06/8

Laboratory and field procedures appropriate for measuring the effectiveness of active noise reduction (ANR) devices mounted in flight helmets, armoured-vehicle crew helmets, communication headsets, and circumaural hearing protectors are described. The procedures described are: ear canal measurements using real subjects or an acoustic test fixture (ATF), masked-threshold and loudness-balance psychophysical procedures, a signal detection procedure, and speech reception procedures using modified rhyme and diagnostic rhyme test (MRT, DRT) and Speech Transmission Index (STI) measures. GRA

N90-13938# Anacapa Sciences, Inc., Fort Rucker, AL.
HUMAN FACTORS RESEARCH IN AIRCREW PERFORMANCE AND TRAINING Final Report, Oct. 1987 - Oct. 1988
THEODORE B. ALDRICH and D. M. MCANULTY Aug. 1989 139 p
(Contract MDA903-87-C-0523)
(AD-A213285; ASI-690-319-88; ARI-TR-858) Avail: NTIS HC A07/MF A01 CSCL 23/2

This report presents summaries of the research projects performed by Anacapa Sciences, Inc., for the ARI Aviation R and D Activity (ARIARDA) at Fort Rucker, Alabama. From 9 October 1987 to 8 October 1988, Anacapa personnel worked on 25 research projects and took part in 6 technical advisory services that address emerging aviation weapon systems design, manpower and personnel programs, and aviator training research. The summary for each project and technical advisory service contains: (1) a background section that describes the rational for the project and specifies the research objectives, (2) a research approach section that describes the tasks and activities required to meet the project objectives (3) a results section that describes the research findings or, in the case of developmental activities, the research product, and (4) a project status section that describes the work completed and projections for future research, if any. GRA

N90-14408# Forschungsinstitut fuer Anthropotechnik, Wachtberg (Germany, F.R.).
HUMAN FACTORS ASPECTS OF DECISION SUPPORT SYSTEMS
K. F. KRAISS *In* AGARD, Operational Decision Aids for Exploiting or Mitigating Electromagnetic Propagation Effects 14 p Sep. 1989
Copyright Avail: NTIS HC A20/MF A03

Human factors aspects of decision support system (DSS) design and various relevant dimensions are identified in decision making and problems solving, followed by a discussion of characteristics and constraints in human information processing. On this basis, design goals and guidelines are identified. The implementation of DSS concerns the layout of the human computer interface, the degree of automation, as well as the selection of suitable decision aiding algorithms. It is shown that a novel systems architecture is needed to ensure cooperative task performance of the man computer team. Finally various problems of interacting with DSS and a compilation of available operational experience are addressed. Author

N90-14772# Civil Aeromedical Inst., Oklahoma City, OK.
PERFORMANCE EVALUATION OF THE PURITAN-BENNETT CREW-MEMBER PORTABLE PROTECTIVE BREATHING DEVICE AS PRESCRIBED BY PORTIONS OF FAA ACTION NOTICE A-8150.2 Final Report
E. A. HIGGINS, G. A. MCLEAN, P. J. LYNE, G. E. FUNKHOUSER, and J. W. YOUNG May 1989 101 p
(AD-A211113; DOT/FAA/AM-89-8) Avail: NTIS HC A06/MF A01 CSCL 05/8

This study was undertaken, on request, to evaluate the performance of the Puritan-Bennett portable crew protective breathing device for contaminant leaks. Tests were conducted in the facilities of the FAA Civil Aeromedical Institute (CAMI) in Oklahoma City, OK. The test sequence followed an iterative process in which problems were identified, modifications made to correct deficiencies, and the device retested until problems could be solved. With adequate quality assurance, the final version of the Puritan-Bennett crewmember portable protective breathing device, as tested at CAMI, would meet the requirements of FAA's Action Notice A-8150.2 regarding contaminant leak protection, O2 concentration, CO2 concentration, inhalation/exhalation pressures and inhalation temperature. GRA

N90-14773# Federal Aviation Administration, Oklahoma City, OK. Civil Aeromedical Inst.
COMPARISON OF PROTECTIVE BREATHING EQUIPMENT PERFORMANCE AT GROUND LEVEL AND 8,000 FEET ALTITUDE USING PARAMETERS PRESCRIBED BY PORTIONS OF FAA ACTION NOTICE A-8150.2 Final Report
T. T. SCHLEGEL, E. A. HIGGINS, G. A. MCLEAN, P. J. LYNE, H. M. ENGLAND, and P. A. ATTOCKNIE Jun. 1989 19 p

(AD-A212852; DOT/FAA/AM-89-10) Avail: NTIS HC A03/MF A01 CSCL 23/5

Two types of crewmember protective breathing equipment (PBE) were performance tested for compliance with Action Notice A-8150.2 at ground level (-1,300 feet) and 8,000 feet altitude. PBE 1 was a hood with oral-nasal mask, which used potassium superoxide to remove carbon dioxide and produce its oxygen supply. PBE 2 was a hood only, which contained lithium hydroxide to absorb carbon dioxide and compressed oxygen cylinders to supply breathable air. The parameters tested were PBE oxygen and carbon dioxide levels, temperature, and breathing resistance-pressure. Five units of each PBE type were subjected to testing; for within-PBE comparisons each type of unit was worn by the same human subjects at both altitudes. Relatively little difference in PBE performance was obtained at the different altitudes for both types of PBE. Oxygen partial pressures were somewhat reduced at the higher altitude for both types of PBE, carbon dioxide partial pressure was slightly greater at ground level for PBE 2, internal temperature was higher for PBE performed adequately for the intended purpose at either altitude , but further testing would be necessary to certify PBE to meet additional requirements, such as use at altitudes above 8,000 feet. GRA

N90-14774# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
INTEGRATED G-SUIT/IMMERSION SUIT
JAMES A. FIRTH and JEAN C. STEFFLER Jun. 1989 32 p
(AD-A212989; DCIEM-89-TR-22) Avail: NTIS HC A03/MF A01 CSCL 06/8

Canadian Forces (CF) aircrew flying CF18 and CF5 aircraft are required to wear anti-G suits to provide protection against the effects of high G forces experienced during air combat maneuvers (ACM). They are also required to wear immersion suits with the G suits on domestic coastal operations to provide protection against hypothermia in the event of an emergency involving ejection and water landing. The standard CF anti-G suit was worn over the immersion suit, which being bulky, created discomfort and contributed to reduced G protection this combination does not permit proper G suit fit on the wearer. The National Defense Headquarters (NDHQ) tasked the Medical Life Support Division (MLSD) of this Institute (DCIEM) to develop a Canadian anti-G suit incorporating fixtures which would allow the anti-G suit to be worn under the immersion. MLSD identified suitable hardware to suit. In conjunction with MLSD support, a Canadian Aerospace Company manufactured two prototype anti-G suits which were successfully integrated with the immersion suit. Subsequent to favorable comments from initial flights trials, NDHQ directed MLSD to procure 20 modified anti-G suits for user trial by designated CF18 and CF5 aircraft squadrons. As a consequence of user trial acceptance, NDHQ has ordered sufficient quantities of the modified anti-G suit and associated immersion suit interface hardware to meet a foreseeable operational requirement. GRA

N90-14775 Surrey Univ., London (England).
THE DEVELOPMENT OF A MODEL OF THE HUMAN RESPONSES TO LOAD CARRIAGE Ph.D. Thesis
IAN P. M. RANDLE 1988 351 p
Avail: Univ. Microfilms Order No. BRDX85648

Past research on manual load carriage has had very limited applicability to the type of load carriage which occurs in industry. The majority of studies have investigated steady continuous load carriage on the back, rather than the intermittent shuttle type of carry in the arms which is more common in industry. Furthermore concentration was generally on the central cardiovascular or metabolic responses, and paid little attention to local muscle fatigue. The highly stylized modes of carriage used in some previous studies were also shown to differ significantly from the more realistic freely chosen modes used. This further limits their applicability. Although potentially useful, current prediction models for load carriage tasks were found to be inappropriate for intermittent carrying, and had a poor level of agreement. A need was identified therefore to develop prediction models for industrial load carriage tasks, and to make a systematic study of local muscle fatigue in load carriage. A methodology for investigating local muscle fatigue was also developed. Despite high levels of intra- and inter-subject variability in response, this medthodology proved useful in detecting the task conditions which were most associated with peripheral muscle fatigue. Dissert. Abstr.

N90-14776# Oak Ridge National Lab., TN. Engineering Physics and Mathematics Div.
HUMAN FACTORS SURVEY OF ADVANCED INSTRUMENTATION AND CONTROLS
RICHARD J. CARTER 1989 22 p Presented at the 17th Water Reactor Safety Information Meeting, Rockville, MD, 23-25 Oct. 1989
(Contract DE-AC05-84OR-21400)
(DE90-002477; CONF-8910222-5) Avail: NTIS HC A03/MF A01

A survey oriented towards identifying the human factors issues in regard to the use of advanced instrumentation and controls (I and C) in the nuclear industry was conducted. A number of United States (U.S.) and Canadian nuclear vendors and utilities were participants in the survey. Human factors items, subsumed under the categories of computer-generated displays (CGD), controls, organizational support, training, and related topics, were discussed. The survey found the industry to be concerned about the human factors issues related to the implementation of advanced I and C. Fifteen potential human factors problems were identified. They include: the need for an advanced I and C guideline equivalent to NUREG-0700; a role change in the control room from operator to supervisor; information overload; adequacy of existing training technology for advanced I and C; and operator acceptance and trust. DOE

N90-14777# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, ID.
HUMAN FACTORS EVALUATION OF ELECTROLUMINESCENT DISPLAY NUMBER 1
JACK L. AUFLICK Aug. 1989 18 p
(Contract DE-AC07-76ID-01570)
(DE90-002231; EGG-HFRU-8654) Avail: NTIS HC A03/MF A01

This report consists of an an electroluminescent display, done by scientists and researchers in the Human Factors Research Unit at EG&G, Idaho, Inc. The purpose of this evaluation was to examine the 'Sunlight Readability' of one electroluminescent (EL) display; a display which may be incorporated into a new generation of US Army diesel generators. The basic finding of this evaluation is that this particular EL display is not sunlight readable. DOE

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SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

N90-13939*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
CELLS IN SPACE
JEAN D. SIBONGA, ed., RICHARD C. MAINS, ed., THOMAS N. FAST, ed. (Santa Clara Univ., CA.), PAUL X. CALLAHAN, ed., and CHARLES M. WINGET, ed. Aug. 1989 310 p Conference held in San Juan Bautista, CA, 31 Oct. - 4 Nov. 1988
(NASA-CP-10034; A-89131; NAS 1.55:10034) Avail: NTIS HC A14/MF A02 CSCL 06/3

Discussions and presentations addressed three aspects of cell research in space: the suitability of the cell as a subject in microgravity experiments, the requirements for generic flight hardware to support cell research, and the potential for collaboration between academia, industry, and government to develop these studies in space. Synopses are given for the presentations and follow-on discussions at the conference and papers are presented from which the presentations were based.

An Executive Summary outlines the recommendations and conclusions generated at the conference.

N90-13940*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
FUNDAMENTAL RESULTS FROM MICROGRAVITY CELL EXPERIMENTS WITH POSSIBLE COMMERCIAL APPLICATIONS
CHARLES M. WINGET, THOMAS N. FAST, WILLIAMS E. HINDS, R. L. SCHAEFER (Lockheed Engineering and Sciences Co., Houston, TX.), and PAUL X. CALLAHAN *In its* Cells in Space p 65-69 Aug. 1989
Avail: NTIS HC A14/MF A02 CSCL 06/3

Some of the major milestones are presented for studies in cell biology that were conducted by the Soviet Union and the United States in the upper layers of the atmosphere and in outer space for more than thirty-five years. The goals have changed as new knowledge is acquired and the priorities for the use of microgravity have shifted toward basic research and commercial applications. Certain details concerning the impact of microgravity on cell systems is presented. However, it needs to be emphasized that in planning and conducting microgravity experiments, there are some important prerequisites not normally taken into account. Apart from the required background knowledge of previous microgravity and ground-based experiments, the investigator should have the understanding of the hardware as a physical unit, the complete knowledge of its operation, the range of its capabilities and the anticipation of problems that may occur. Moreover, if the production of commercial products in space is to be manifested, data obtained from previous microgravity experiments must be used to optimize the design of flight hardware. Author

N90-13941*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
THE PITUITARY GROWTH HORMONE CELL IN SPACE
WESLEY C. HYMER (Pennsylvania State Univ., University Park.) and R. GRINDELAND *In its* Cells in Space p 71-75 Aug. 1989
Avail: NTIS HC A14/MF A02 CSCL 06/3

Growth hormone (GH), produced and secreted from specialized cells in the pituitary gland, controls the metabolism of protein, fat, and carbohydrate. It is also probably involved in the regulation of proper function of bone, muscle and immune systems. The behavior of the GH cell system was studied by flying either isolated pituitary cells or live rats. In the latter case, pituitary GH cells are prepared on return to earth and then either transplanted into hypophysectomized rats or placed into cell culture so that function of GH cells in-vivo vs. in-vitro can be compared. The results from three flights to date (STS-8, 1983; SL-3, 1985; Cosmos 1887, 1987) established that the ability of GH cells to release hormone, on return to earth, is compromised. The mechanism(s) responsible for this attenuation response is unknown. However, the data are sufficiently positive to indicate that the nature of the secretory defect resides directly within the GH cells. Author

N90-13942*# Louisville Univ., KY. Dept. of Microbiology and Immunology.
RESPONSE OF LYMPHOCYTES TO A MITOGENIC STIMULUS DURING SPACEFLIGHT
GERALD SONNENFELD *In* NASA, Ames Research Center, Cells in Space p 77-85 Aug. 1989
(Contract NCC2-213; NAG9-181; NAG9-234)
Avail: NTIS HC A14/MF A02 CSCL 06/3

Several studies were performed that demonstrate that immunological activities of lymphocytes can be affected by spaceflight or by models that attempt to simulate some aspects of weightlessness. Included among these are the responses of lymphocytes to external stimuli such as mitogens and viruses. When cultures of lymphocytes were flown in space, the ability of the lymphocytes to respond to mitogens was inhibited. Similar results were obtained when lymphocytes from astronauts or animals just returned from space were placed into culture immediately upon return to earth, and when models of hypogravity were used. Lymphocytes placed in culture during spaceflights produced enhanced levels of interferon compared to control cultures. When cultures of lymphocytes were prepared for cosmonauts or rodents immediately upon return to earth, interferon production was inhibited. These results suggest that space flight can have profound effects on lymphocyte function, and that effects on isolated cells may be different from that on cells in the whole organism. Author

N90-13943*# State Univ. of New York, Stony Brook. Dept. of Biochemistry.
POLARITY ESTABLISHMENT, MORPHOGENESIS, AND CULTURED PLANT CELLS IN SPACE
ABRAHAM D. KRIKORIAN *In* NASA, Ames Research Center, Cells in Space p 87-95 Aug. 1989
(Contract NSG-7270)
Avail: NTIS HC A14/MF A02 CSCL 06/3

Plant development entails an orderly progression of cellular events both in terms of time and geometry. There is only circumstantial evidence that, in the controlled environment of the higher plant embryo sac, gravity may play a role in embryo development. It is still not known whether or not normal embryo development and differentiation in higher plants can be expected to take place reliably and efficiently in the micro g space environment. It seems essential that more attention be given to studying aspects of reproductive biology in order to be confident that plants will survive seed to seed to seed in a space environment. Until the time arrives when successive generations of plants can be grown, the best that can be done is utilize the most appropriate systems and begin, piece meal, to accumulate information on important aspects of plant reproduction. Cultured plant cells can play an important role in these activities since they can be grown so as to be morphogenetically competent, and thus can simulate those embryogenic events more usually identified with fertilized eggs in the embryo sac of the ovule in the ovary. Also, they can be manipulated with relative ease. The extreme plasticity of such demonstrably totipotent cell systems provides a means to test environmental effects such as micro g on a potentially free-running entity. The successful manipulation and management of plant cells and propagules in space also has significance for exploitation of biotechnologies in space since such systems, perforce, are an important vehicle whereby many genetic engineering manipulations are achieved. Author

N90-13944*# Loma Linda Univ., CA. Dept. of Microbiology.
THE SENSORY TRANSDUCTION PATHWAYS IN BACTERIAL CHEMOTAXIS
BARRY L. TAYLOR *In* NASA, Ames Research Center, Cells in Space p 97-102 Aug. 1989
Avail: NTIS HC A14/MF A02 CSCL 06/3

Bacterial chemotaxis is a useful model for investigating in molecular detail the behavioral response of cells to changes in their environment. Peritrichously flagellated bacteria such as coli and typhimurium swim by rotating helical flagella in a counterclockwise direction. If flagellar rotation is briefly reversed, the bacteria tumble and change the direction of swimming. The bacteria continuously sample the environment and use a temporal sensing mechanism to compare the present and immediate past environments. Bacteria respond to a broad range of stimuli including changes in temperature, oxygen concentration, pH and osmotic strength. Bacteria are attracted to potential sources of nutrition such as sugars and amino acids and are repelled by other chemicals. In the methylation-dependent pathways for sensory transduction and adaptation in E. coli and S. typhimurium, chemoeffectors bind to transducing proteins that span the plasma membrane. The transducing proteins are postulated to control the rate of autophosphorylation of the CheA protein, which in turn phosphorylates the CheY protein. The phospho-CheY protein binds to the switch on the flagellar motor and is the signal for clockwise rotation of the motor. Adaptation to an attractant is achieved by increasing methylation of the transducing protein until the attractant stimulus is cancelled. Responses to oxygen and certain sugars involve methylation-independent pathways in which adaption occurs

without methylation of a transducing protein. Taxis toward oxygen is mediated by the electron transport system and changes in the proton motive force. Recent studies have shown that the methylation-independent pathway converges with the methylation-dependent pathway at or before the CheA protein. Author

N90-13945*# National Inst. of Standards and Technology, Boulder, CO. Chemical Engineering Science Div.
PHYSICAL PHENOMENA AND THE MICROGRAVITY RESPONSE
PAUL TODD *In* NASA, Ames Research Center, Cells in Space p 103-116 Aug. 1989
Avail: NTIS HC A14/MF A02 CSCL 06/3

The living biological cell is not a sack of Newtonian fluid containing systems of chemical reactions at equilibrium. It is a kinetically driven system, not a thermodynamically driven system. While the cell as a whole might be considered isothermal, at the scale of individual macromolecular events there is heat generated, and presumably sharp thermal gradients exist at the submicron level. Basic physical phenomena to be considered when exploring the cell's response to inertial acceleration include particle sedimentation, solutal convection, motility electrokinetics, cyto-skeletal work, and hydrostatic pressure. Protein crystal growth experiments, for example, illustrate the profound effects of convection currents on macromolecular assembly. Reaction kinetics in the cell vary all the way from diffusion-limited to life-time limited. Transport processes vary from free diffusion, to facilitated and active transmembrane transport, to contractile-protein-driven motility, to crystalline immobilization. At least four physical states of matter exist in the cell: aqueous, non-aqueous, immiscible-aqueous, and solid. Levels of order vary from crystalline to free solution. The relative volumes of these states profoundly influence the cell's response to inertial acceleration. Such subcellular phenomena as stretch-receptor activation, microtubule re-assembly, synaptic junction formation, chemotactic receptor activation, and statolith sedimentation were studied recently with respect to both their basic mechanisms and their responsiveness to inertial acceleration. From such studies a widespread role of cytoskeletal organization is becoming apparent. Author

N90-13946*# Washington Univ., Seattle. Dept. of Botany.
HOW TO DETECT WHEN CELLS IN SPACE PERCEIVE GRAVITY
THOMAS BJOERKMAN *In* NASA, Ames Research Center, Cells in Space p 117-120 Aug. 1989
Avail: NTIS HC A14/MF A02 CSCL 06/3

It is useful to be able to measure when and whether cells detect gravity during spaceflights. For studying gravitational physiology, gravity perception is the response the experimentalist needs to measure. Also, for growing plants in space, plant cells may have a non-directional requirement for gravity as a development cue. The main goals of spaceflight experiments in which gravity perception would be measured are to determine the properties of the gravity receptor and how it is activated, and to determine fundamental characteristics of the signal generated. The main practical difficulty with measuring gravity sensing in space is that gravity sensing cannot be measured with certainty on earth. Almost all experiments measure gravitropic curvature. Reciprocity and intermittent stimulation are measurements which were made to some degree on earth using clinostatting, but which would provide clearer results if done with microgravity rather than clinostatting. These would be important uses of the space laboratory for determining the nature of gravity sensing in plants. Those techniques which do not use gravitropic curvature to measure gravity sensing are electrophysiological. The vibrating probe would be somewhat easier to adapt to space conditions than the intracellular microelectrode because it can be positioned with less precision. Ideally, a non-invasive technique would be best suited if an appropriate measure could be developed. Thus, the effect of microgravity on cultured cells is more likely to be by large-scale physical events than gravity sensing in the culture cells. It is not expected that it will be necessary to determine whether individual cultured cells perceive gravity unless cells grow abnormally even after the obvious microgravity effects on the culture as a whole can be ruled out as the cause. Author

N90-13947*# Michigan State Univ., East Lansing. Dept. of Botany.
EFFECTS OF MICROGRAVITY ON GROWTH HORMONE CONCENTRATION AND DISTRIBUTION IN PLANTS
AGA SCHULZE, PHILIP JENSEN, MARK DESROSIERS, and ROBERT S. BANDURSKI *In* NASA, Ames Research Center, Cells in Space p 121-131 Aug. 1989
Avail: NTIS HC A14/MF A02 CSCL 06/3

On earth, gravity affects the distribution of the plant growth hormone, indole-3-acetic acid (IAA), in a manner such that the plant grows into a normal vertical orientation (shoots up, roots down). How the plant controls the amount and distribution of IAA is only partially understood and is currently under investigation in this laboratory. The question to be answered in the flight experiment concerns the effect of gravity on the concentration, turn over, and distribution of the growth hormone. The answer to this question will aid in understanding the mechanism by which plants control the amount and distribution of growth hormone. Such knowledge of a plant's hormonal metabolism may aid in the growth of plants in space and will lead to agronomic advances. Author

N90-13948*# University City Science Center, Philadelphia, PA. Gravitational Plant Physiology Lab.
GRAVITY RECEPTORS AND RESPONSES
ALLAN H. BROWN *In* NASA, Ames Research Center, Cells in Space p 133-138 Aug. 1989
Avail: NTIS HC A14/MF A02 CSCL 06/3

The overall process of gravity sensing and response processes in plants may be divided conveniently into at least four components or stages: Stimulus susception (a physical event, characteristically the input to the G receptor system of environmental information about the G force magnitude, its vector direction, or both); information perception (an influence of susception on some biological structure or process that can be described as the transformation of environmental information into a biologicallly meaningful change); information transport (the export, if required, of an influence (often chemical) to cells and organs other than those at the sensor location); and biological response (almost always (in plants) a growth change of some kind). Some analysts of the process identify, between information perception and information transport, an additional stage, transduction, which would emphasize the importance of a transformation from one form of information to another, for example from mechanical statolith displacement to an electric, chemical, or other alteration that was its indirect result. These four (or five) stages are temporally sequential. Even if all that occurs at each stage can not be confidently identified, it seems evident that during transduction and transport, matters dealt with are found relatively late in the information flow rather than at the perception stage. As more and more is learned about the roles played by plant hormones which condition the G responses, the mechanism(s) of perception which should be are not necessarily better understood. However, if by asking the right questions and being lucky with experiments perhaps the discovery of how some process (such as sedimentation of protoplasmic organelles) dictates what happens down stream in the information flow sequence may be made. Author

N90-13949*# Arizona Univ., Tucson. Dept. of Physics.
FREE SWIMMING ORGANISMS: MICROGRAVITY AS AN INVESTIGATIVE TOOL
JOHN O. KESSLER *In* NASA, Ames Research Center, Cells in Space p 139-152 Aug. 1989
Avail: NTIS HC A14/MF A02 CSCL 06/3

On earth, micro-organisms are in the grip of gravitational and viscous forces. These forces, in combination with sensory stimuli, determine the average orientation of the organisms' swimming trajectories relative to the fluid environment. Microgravity provides the opportunity to study the rules which govern the summation or orienting influences and to develop quantitative physical

measurements of sensory responses, e.g. the measurement of phototactic orientation tendency in torque units. Also, by reducing or eliminating density anisotropy-driven buoyant convection, it will be possible to study illumination, temperature gradient and concentration gradient-mediated collective dynamics. Author

N90-13950*# Pennsylvania State Univ., University Park. Dept. of Biology.
GRAVITROPISM IN PLANTS: HYDRAULICS AND WALL GROWTH PROPERTIES OF RESPONDING CELLS
DANIEL J. COSGROVE *In* NASA, Ames Research Center, Cells in Space p 153-156 Aug. 1989
Avail: NTIS HC A14/MF A02 CSCL 06/3

Gravitropism is the asymmetrical alteration of plant growth in response to a change in the gravity vector, with the typical result that stems grow up and roots grow down. The gravity response is important for plants because it enables them to grow their aerial parts in a mechanically stable (upright) position and to develop their roots and leaves to make efficient use of soil nutrients and sunlight. The elucidation of gravitropic responses will tell much about how gravity exerts its morphogenetic effects on plants and how plants regulate their growth at the cellular and molecular levels. Author

N90-13951*# California Univ., Davis.
GRAVITY AND ANIMAL EMBRYOS
LYNN M. WILEY *In* NASA, Ames Research Center, Cells in Space p 157-160 Aug. 1989
Avail: NTIS HC A14/MF A02 CSCL 06/3

Out of more than 4,500 rat hours in space there was only one experimental attempt (Cosmos 1129) at mating with an apparent absence of fertilization, implantation and subsequent development to term and partuition. Portions of this process were successfully flown, however, including the major portion of organogenesis in the rat (Cosmos 1524). These observations show that the cellular and molecular events underlying morphogenesis and differentiation in a small mammal can proceed normally in-utero under microgravity and other conditions encountered during short-duration flight. However, it is not known whether this situation will hold for larger mammals over several generations during extended missions that venture outside of near Earth. Furthermore, it is not understood why the previous attempt at obtaining copulation, fertilization and implantation in orbit failed but may be related to limitations of the rat habitat for meeting the preconditions for reproductive behavior. With respect to mammalian development it is important to appreciate that fertilization and development occur internally within the female and take a long time to complete and their success will, therefore, be contingent upon the maternal response to the space environment. One process central to development (the establishment of cell lines) is initiated prior to implantation by environmental asymmetries preceived by progenitor cells. These asymmetries appear to result from the formation of asymmetric cell-cell contacts and the concommitant development of an electrical axis across the progenitor cells. Other asymmetries were also documented. It is not known whether any of the known asymmetries perceived by progenitor cells are influenced by gravity vectors and/or by the maternal response to microgravity and other conditions encountered in space. Author

N90-13952*# Lockheed Missiles and Space Co., Sunnyvale, CA. Bioastronautics Div.
HUMAN FACTORS ISSUES IN PERFORMING LIFE SCIENCE EXPERIMENTS IN A 0-G ENVIRONMENT
WAYNE GONZALEZ *In* NASA, Ames Research Center, Cells in Space p 161-165 Aug. 1989
Avail: NTIS HC A14/MF A02 CSCL 06/3

An overview of the environmental conditions within the Spacelab and the planned Space Station Freedom is presented. How this environment causes specific Human Factors problems and the nature of design solutions are described. The impact of these problems and solutions on the performance of life science activities onboard Spacelab (SL) and Space Station Freedom (SSF) is discussed. The first area highlighted is contamination. The permanence of SSF in contrast to the two-week mission of SL has significant impacts on crew and specimen protection requirements and, thus, resource utilization. These requirements, in turn impose restrictions on working volumes, scheduling, training, and scope of experimental procedures. A second area is microgravity. This means that all specimens, materials, and apparatus must be restrained and carefully controlled. Because so much of the scientific activity must occur within restricted enclosures (gloveboxes), the provisions for restraint and control are made more complex. The third topic is crewmember biomechanics and the problems of movement and task performance in microgravity. In addition to the need to stabilize the body for the performance of tasks, performance of very sensitive tasks such as dissection is difficult. The issue of space sickness and adaption is considered in this context. Author

N90-13953*# Pennsylvania Univ., Philadelphia.
DO THE DESIGN CONCEPTS USED FOR THE SPACE FLIGHT HARDWARE DIRECTLY AFFECT CELL STRUCTURE AND/OR CELL FUNCTION GROUND BASED SIMULATIONS
DAVID K. CHAPMAN *In* NASA, Ames Research Center, Cells in Space p 167-176 Aug. 1989
Avail: NTIS HC A14/MF A02 CSCL 06/3

The use of clinostats and centrifuges to explore the hypogravity range between zero and 1 g is described. Different types of clinostat configurations and clinostat-centrifuge combinations are compared. Some examples selected from the literature and current research in gravitational physiology are presented to show plant responses in the simulated hypogravity region of the g-parameter (0 is greater than g is greater than 1). The validation of clinostat simulation is discussed. Examples in which flight data can be compared to clinostat data are presented. The data from 3 different laboratories using 3 different plant species indicate that clinostat simulation in some cases were qualitatively similar to flight data, but that in all cases were quantitatively different. The need to conduct additional tests in weightlessness is emphasized. Author

N90-13954*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MODEL SYSTEM STUDIES WITH A PHASE SEPARATED MEMBRANE BIOREACTOR
G. R. PETERSEN, P. K. SESHAN, and ERIC H. DUNLOP (Colorado State Univ., Fort Collins.) *In* NASA, Ames Research Center, Cells in Space p 177-185 Aug. 1989
Avail: NTIS HC A14/MF A02 CSCL 06/3

The operation and evaluation of a bioreactor designed for high intensity oxygen transfer in a microgravity environment is described. The reactor itself consists of a zero headspace liquid phase separated from the air supply by a long length of silicone rubber tubing through which the oxygen diffuses in and the carbon dioxide diffuses out. Mass transfer studies show that the oxygen is film diffusion controlled both externally and internally to the tubing and not by diffusion across the tube walls. Methods of upgrading the design to eliminate these resistances are proposed. Cell growth was obtained in the fermenter using Saccharomyces cerevisiae showing that this concept is capable of sustaining cell growth in the terrestial simulation. Author

N90-13955*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DESIGN CHALLENGES FOR SPACE BIOREACTORS
P. K. SESHAN and G. R. PETERSEN *In* NASA, Ames Research Center, Cells in Space p 187-205 Aug. 1989
Avail: NTIS HC A14/MF A02 CSCL 06/3

The design of bioreactors for operation under conditions of microgravity presents problems and challenges. Absence of a significant body force such as gravity can have profound consequences for interfacial phenomena. Marangoni convection can no longer be overlooked. Many speculations on the advantages and benefits of microgravity can be found in the literature. Initial bioreactor research considerations for space applications had little regard for the suitability of the designs for conditions of microgravity. Bioreactors can be classified in terms of their function and type

of operation. The complex interaction of parameters leading to optimal design and operation of a bioreactor is illustrated by the JSC mammalian cell culture system. The design of a bioreactor is strongly dependent upon its intended use as a production unit for cell mass and/or biologicals or as a research reactor for the study of cell growth and function. Therefore a variety of bioreactor configurations are presented in rapid summary. Following this, a rationale is presented for not attempting to derive key design parameters such as the oxygen transfer coefficient from ground-based data. A set of themes/objectives for flight experiments to develop the expertise for design of space bioreactors is then proposed for discussion. These experiments, carried out systematically, will provide a database from which engineering tools for space bioreactor design will be derived. Author

N90-13956*# Colorado State Univ., Fort Collins. Dept. of Chemical Engineering.
FERMENTATION AND OXYGEN TRANSFER IN MICROGRAVITY
ERIC H. DUNLOP *In* NASA, Ames Research Center, Cells in Space p 207-211 Aug. 1989
Avail: NTIS HC A14/MF A02 CSCL 06/3

The need for high rate oxygen transfer in microgravity for a Controlled Ecological Life Support System (CELSS) environment offers a number of difficulties and challenges. The use of a phase separated bioreactor appears to provide a way of overcoming these problems resulting in a system capable of providing high cell densities with rapid fermentation rates. Some of the key design elements are discussed. Author

N90-13957*# Colorado Univ., Boulder. Aerospace Engineering Sciences and Bioserve Space Technologies.
COUNTERMEASURES TO MICROGRAVITY
MARVIN W. LUTTGES *In* NASA, Ames Research Center, Cells in Space p 213-220 Aug. 1989
Avail: NTIS HC A14/MF A02 CSCL 06/3

Biological systems ranging from the most simple to the most complex generally survive exposure to microgravity. Changes in many characteristics of biological systems are well documented as a consequence of space flight. Attempts to devise countermeasures to microgravity may have direct pragmatic consequences for crew protection and may provide additional insights into the nature of microgravity influences on biological systems. Some of the most well documented changes occur in humans who have experienced space flight. Changes appear to be transient. Space adaption syndrome occurs relatively briefly whereas bone deterioration may require months of postflight time for restoration. It seems critical to recognize that these changes and others may derive from rather passive, active or even reactive changes in the biological systems that are hosts to them. For example, hydrostatic fluid redistributions may be quite passive occurrences that are realized through extensive fluid channels. Changes occur in cell metabolism because of fluid, nutrient and gas redistributions. Equally important are the misconstrued messages likely to be carried by fluid redistributions. These reactive events can trigger, for example, loss of fluids and electrolytes through altered kidney function. Each of these considerations must be evaluated in regard to the biological site affected. Countermeasures to the vast range of biological changes and sites are difficult to envision. The most obvious countermeasure is the restoration of gravity-like influences. Some options are discussed. Recent work has focussed on the use of magnetic fields. Pulsed electromagnetic fields (PEMF) are shown to alleviate bone deterioration produced in rodents exposed to tail suspension. Methods of PEMF exposure are consistent with human use in space. Related methods may provide muscular and neural benefits. Author

N90-13958*# Lunar Radiation Corp., Madison, WI.
BONE MINERAL MEASUREMENT USING DUAL ENERGY X RAY DENSITOMETRY
STEVEN W. SMITH *In* NASA, Ames Research Center, Cells in Space p 221-224 Aug. 1989
Avail: NTIS HC A14/MF A02 CSCL 06/3

Bone mineral measurements before and after space missions have shown that weightlessness greatly accelerates bone demineralization. Bone mineral losses as high as 1 to 3 percent per month were reported. Highly precise instrumentation is required to monitor this loss and thereby test the efficacy of treatment. During the last year, a significant improvement was made in Dual-Photon Absorptiometry by replacing the radioactive source with an x ray tube. Advantages of this system include: better precision, lower patient dose, better spacial resolution, and shorter scan times. The high precision and low radiation dose of this technique will allow detection of bone mineral changes of less than 1 percent with measurements conducted directly at the sites of interest. This will allow the required bone mineral studies to be completed in a shorter time with greater confidence. Author

N90-14778*# National Aeronautics and Space Administration, Washington, DC.
EXPLORING THE LIVING UNIVERSE: A STRATEGY FOR SPACE LIFE SCIENCES
Jun. 1988 231 p Original contains color illustrations
(NASA-TM-101891; NAS 1.15:101891) Avail: NTIS HC A11/MF A02 CSCL 06/3

The status and goals of NASA's life sciences programs are examined. Ways and mean for attaining these goals are suggested. The report emphasizes that a stronger life sciences program is imperative if the U.S. space policy is to construct a permanently manned space station and achieve its stated goal of expanding the human presence beyond earth orbit into the solar system. The same considerations apply in regard to the other major goal of life sciences: to study the biological processes and life in the universe. A principal recommendation of the report is for NASA to expand its program of ground- and space-based research contributing to resolving questions about physiological deconditioning, radiation exposure, potential psychological difficulties, and life support requirements that may limit stay times for personnel on the Space Station and complicate missions of more extended duration. Other key recommendations call for strengthening programs of biological systems research in: controlled ecological life support systems for humans in space, earth systems central to understanding the effects on the earth's environment of both natural and human activities, and exobiology. J.P.S.

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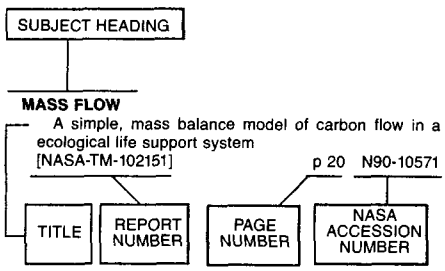

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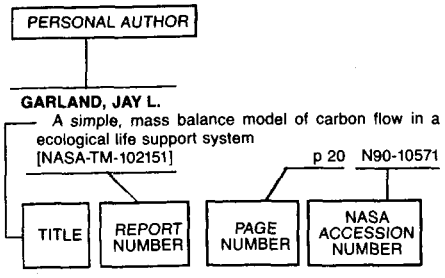

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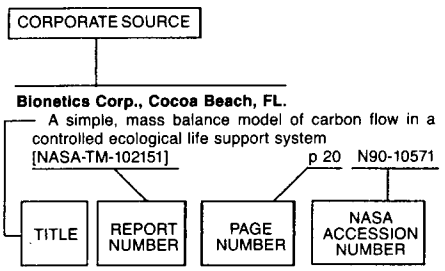

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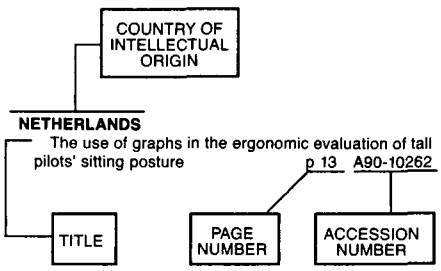

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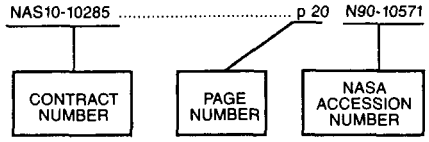

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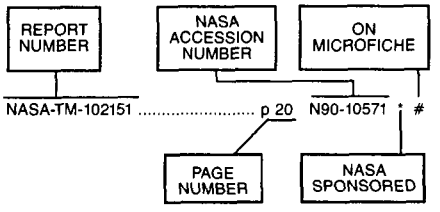

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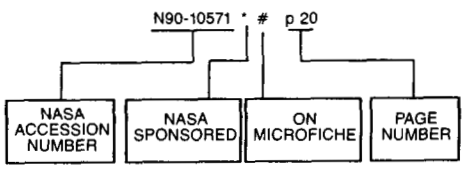

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